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NOTES ON THE ETHNOLOGY OF THE CONGO.

BY WALTER HOUGH.

THE Congo ranks among the mightiest rivers of the earth. Above the limit of the tide it floods over cataracts and miles of rapids bristling with rocks in its descent from the high African uplands. Indeed, it was a revelation to indomitable Stanley to find, after these obstacles were passed, navigable water flowing from the far interior.

Along its stretches of turbulent or placid water dwell many tribes of negroes. Cannibals and fierce savages are numerous, and, altogether, it is a dark and dangerous country drained by this river, from where its waters begin, on the common watershed between it and the Nile, to its mouth on the west coast. The great wealth of ivory, dye-wood, rubber, palm-oil, and other products makes it profitable to establish many stations for traffic. The "Congo Free State," governed by Leopold, of Belgium, embraces a large territory gradually being explored and opened up to commerce.

Up to one year or so ago the National Museum possessed very few ethnological specimens from Africa, at which time Mr. W. P. Tisdel, agent of the United States to the Free States, brought home the first collection from that unknown region. Recently Lieutenant E. H. Taunt, U.S.N., visited the Upper Congo, and sent to the museum a large collection of barbaric weapons, ornaments, and various other objects made by the Congo tribes. These collections, with the one lately acquired from the Bureau of Arts in Paris, enable us to speak with some

degree of confidence about the customs and arts of these Africans. The collections are, as one would reason, rich in weapons and poor in clothing, coming from the region of perpetual feud and almost utter nakedness. It is interesting to remark that nearly all the African tribes know the art of smelting iron, and make a fine quality of metal by the rudest sort of apparatus; in fact, they are in the Iron Age. It is unknown how these savages of low grade became acquainted with the iron-smelting process, —an art which indicates a great step in civilization. Though a matter of conjecture, it is highly probable that from that ancient and mysterious mother of arts and sciences, Egypt, came this knowledge of the use and manufacture of iron throughout the entire "Dark Continent."

Africa is very rich in iron. Travellers have noted great beds of highly-oxidized ore of a kind particularly fitted for these simple operations. The usual method of smelting iron is to pile layers of ore and charred wood in a small mud furnace. A continuous current of air is blown in by two bellows working alternately, or, among the Bongo, there are simply four or five draught-holes at the bottom of the furnace. When the ore has been smelted the furnace is allowed to cool, and the cake of ashes is washed, the lumps of iron collected, reheated, and pounded into a coherent mass with a stone hammer on a stone anvil. The iron thus made is very tenacious and remarkably rust-proof. It is preferred by the natives to steel or foreign iron, because if an assagai-head is bent into an interrogation-point the warrior calmly beats it into shape with a stone. The iron also holds a good edge; in fact, a sharp assagai-head is the razor of the uncivilized barber. The weapons, which are hammered out with a stone, are, despite the fact, finely finished, and are as creditable specimens of smith-work as can be found. The common idea that conventionality and repetition in art argues a low degree of civilization is met by the fact that the aboriginal workman cannot make two things alike. He does not work by pattern; he follows, for instance, the shape of his iron or the suggestion of a chance blow. This is the reason of the so-called "originality" of all peoples not practising division of labor or using machines. Among the forty-five specimens of assagais every one is different, although they can be separated into several groups by general likenesses.

Travellers say that there is rivalry among smiths to produce different and bizarre forms, and, as a result of this, many weapons are made which are of no use, being merely *chef d'œuvres* of the blacksmith. The typical assagai and javelin has a leaf-shaped blade, which is double curved; that is, a horizontal section of the blade would show a curve like a thin §, or like Hogarth's line of beauty. This feature has no special use, as the assagai does not whirl in its flight. At the base of the blade is a socket into which sets the long, slender shaft, usually wound with brass, copper, or iron tape. At the bottom is an iron spud, though not found on those for hurling. It is said that in the act of throwing the weapon the negro gives it a vibratory motion, so that it passes through the air with a whistling sound. Arrows are made with uncomfortable-looking barbed points. Knives are merely assagai-heads fitted into handles. The shields are among the finest specimens of basket-work in the world. They are models of lightness and strength besides. Professor Mason describes the mode of construction, and compares it with the similar work done by the Clallam Indians and the Japanese. He calls it the "fish-trap" style of basketry, and states that "the oblong oval shields of bamboo made by the Bateke negroes of the Lower Congo imitate this structure exactly. The frame of the shield is an oblong hoop on which are stretched splints of rattan running longitudinally on one side and transversely on the other, crossing at right angles except at the plano-convex space at the ends."[1]

Just mentioning the short swords and bill-knives, some of them highly decorated with nut-shell fringe and leopard-skin, we note the executioner's sword. Its blade is short, broad, and heavy, and it is sharp on both sides. It is really in bad taste to describe an execution, but life there is so cheap and the Congo-African way of relieving a man of his head so unique that it will bear description. In order to give an *éclat* suitable to African taste, and to render the feat of decapitating with the weapon possible, the victim is secured to a seat and a strong sapling bent down and fastened by means of cords and a collar around his neck; then, while his neck is taut the high executioner delivers the blow, and the severed head is thrown into the air like a bomb.

[1] Aboriginal Basket-Work, Smithsonian Rept., 1884, ii. p. 298.

The Nyam-Nyam and several Congo tribes have a very peculiar knife-boomerang. It is a weapon sharp on all edges of its blades,—it might be called a collection of knife-blades. It is kept concealed in the shield, and is thrown with a whirling motion, and its wide path and the accuracy and force with which it is thrown make it a dangerous weapon.

At the Stanley Falls Station, now held by the Arabs, a strange kind of money is current, called, from its shape, "spade money," being pieces of iron used as a medium of exchange. The relative rank of money in Africa makes iron equal to copper, and copper to silver. Cloth is a very common barter medium, and its use is mostly not for dress, but the custom is to wrap the dead in many folds of cotton goods. Cotton grows abundantly, and a coarse, narrow cloth is made.

A stuff exactly similar to Mocha coffee-sacking is woven, and highly valued. It is grass-cloth, as it is commonly called; but sometimes it is made of the tough outer bark of some kind of shrub, and it is woven by men. The staple food of the Congo region is manioc, or cassava roots, which are pounded in mortars with large pestles of ivory. Peanuts are also cultivated. Several spoons in the Taunt collection are said to have been used in the cannibal feasts of the Arrhuimi River tribes. Pipes are made of horns, and the bowl is placed on one side. The horn is filled with water, and the smoke is inhaled by suction at the open end. Travellers speak of the extremely intoxicating effect of the tobacco and hemp mixture, which is brought out more powerfully by being drawn through water.

The customs and beliefs of these Africans with regard to the spirit-world are very crude. A belief in evil spirits, witches, good and bad luck comprises nearly all of the religious elements of the negro-life. The "doctor" is the interpreter of religion, and the fetish is a safeguard against all harm. There are many Mohammedans, who practise a debased form of that worship. It seems that no form of religion can withstand the brutalizing effect of the African nature and the childishness of his temperament.

What will be the future of this section of Africa, its relation to the world of commerce, and the extent to which it will be affected by modern civilization are difficult problems. While it is capable of supporting a large population, the climate is malarious and utterly unfit for Europeans. The African seems to have

gained an immunity or idiosyncrasy to miasmatic influences by generations of adaptation. He has made little progress in civilization. This is due to the lack of inherent capability of the negro type more than any other cause. The lack of harbors on the coasts of Africa has always and will in the future militate against the settlement and growth by advanced races. It looks now as if this continent, vast in wealth and area, is becoming overrun by the fierce disciples of Islam, the most undesirable settlers possible, and in whose hands it will be lost in an irreclaimable darkness. Another great bane to the Congo and all Africa is the accursed slave-trade. For over three thousand years she has bartered her children to be slaves over the whole earth. Livingstone, Schweinfurth, Stanley, and many other distinguished explorers have seen, with anguish, this comprehensive atrocity in all its phases, and have tried to perfect plans for putting it down. The Congo Free State, through Henry Stanley, has done much to suppress this evil. That recent brilliant master-stroke of enlisting Tippo Tib, the prince of slave-traders, against the slave-trade cannot receive too much praise, and it is to be hoped that, as another laurel in Stanley's crown, he may successfully rescue Emin Bey, the soldier-scientist, from his perilous position in the heart of Africa, and restore him, with his large collections, to the civilized world.

NOTES ON CLASSIFICATION AND NOMENCLATURE FOR THE AMERICAN COMMITTEE OF THE INTERNATIONAL GEOLOGICAL CONGRESS, MARCH, 1887.

BY N. H. WINCHELL.

THE PALÆOZOIC.—In the light of recent work done in the classic region of American geology, Eastern New York, by Messrs. Ford and Walcott, reviving some of the old questions that separated the geologists of forty years ago into widely variant schools, it becomes appropriate for this committee to earnestly and justly weigh the facts so far as they bear on the choice of names for recommendation to the next congress.

It will have to be admitted that the scheme of stratigraphy

which was erected by Mr. Emmons, including formations that extended eastward into Massachusetts and Vermont, and westward to the Hudson River, covering a series of strata from the gabbros of the Adirondacks to the top of the Lorraine shales, has been overthrown by the researches of Dana and his colleagues,—in other words, that the "Taconic System," as constructed by Dr. Emmons, cannot be maintained.

On the other hand, the Taconic rocks, in which Emmons found primordial fossils, and to which he extended the name which he applied to his system, have been found to have a wide extension and a great thickness, as well as a characteristic fauna. The initial point of divergence between him and his colleagues on the New York survey was as to the existence of such pre-Potsdam strata. From this initial point he built up a system without warrant. He laid a true foundation, but his superstructure was not well built. In consequence of a poor superstructure, the tendency has been strong to sweep away also his foundation, denying to both of them the right to existence in geological nomenclature.

The question that comes before this committee is to determine by what designation the strata shall be known that contain the foundation-rocks of the "Taconic System" of Emmons,—those that really are stratigraphically pre-Potsdam.

Recent palæontological researches and work in the field show that the pre-Potsdam fauna pervades a belt of rocks that extends from Northern Vermont southward, by way of Georgia, Vermont, Bald Mountain, New York, Schodack Landing, to Stockport, Columbia County, east of the Hudson River, comprising a thickness of strata amounting to about four thousand feet. It is also reasonable to suppose that it constitutes the basal portion of the range of the Taconic Mountains, and perhaps a large part of the range in some places. It is therefore not inappropriate to consider the claim of Dr. Emmons to give name to this belt.

(*a*) Taconic *versus* Primordial.

The term *primordial*, adopted by Barrande for the first fauna, is more comprehensive than the fauna that was discovered by Emmons in these Taconic strata. But Barrande distinctly acknowledges that Dr. Emmons antedated him in the discovery and advocacy of a fossil horizon belonging in the primordial

zone. There can be no question, when the author of the term primordial makes such an admission, that, other things being equal, the term first used should be perpetuated. But it may be stated that other things were not equal. They were not equal in the thoroughness with which the fauna was investigated, nor the correctness with which the stratigraphic relationships were stated, nor in the limitations which were placed on its extent. They were not equal in the comprehensive, uninterrupted progress with which the respective investigations were carried on on different sides of the Atlantic, nor the completeness and costliness of publication. But it may be doubted whether any of these differences, or all of them, would warrant the unqualified adoption of the European term, to the exclusion of the American, against the right of priority for the American geologist. Emmons did, it seems to me, all that was required, or that is now required, to establish his claim to the discovery of a new formation. He defined it geographically, stratigraphically, and palæontologically. No one else in America has applied any new name to it. It came in conflict, it is true, with another American designation, but no one now will urge the correctness of that opposing term. As between *Taconic* and *primordial*, both authors may be recognized and honored by confining the term Taconic to the identical horizon, or sub-fauna, in which it was described by Dr. Emmons, allowing the term primordial to embrace, as intended by Barrande, all the sub-faunas of the first fauna.

The first (oldest) sub-fauna is characterized by the genus *Paradoxides.*

The second sub-fauna is characterized by *Olenellus.*

The third sub-fauna is characterized by *Dicelocephalus.*

(*b*) Taconic *versus* Cambrian.

But we cannot overlook the fact that in Europe, and also in America, the term Cambrian is very generally applied to this fauna and the formation in which it is embraced, to the exclusion of both *Taconic* and *primordial.* This is a very singular circumstance. The reaction which set in to do justice to Sedgwick had such momentum that it swept over its own bounds and became itself an agent of injustice.

If the question of the relative dates at which the terms Taconic

and Cambrian were first used be brought to bear on this investigation, the facts will be found to be about as follows:

Murchison says the term Cambrian was first used in print in 1836, but Sedgwick says he had been at work on the formation since 1831, his first description being made and published in brief in the *Proceedings of the British Association for the Advancement of Science* in 1832. In 1855 he also says he had made no material changes in the Cambrian since 1832, except some minor transpositions of stratigraphy. All this time the lower portion of these rocks was considered non-fossiliferous, Sedgwick not being willing even to admit the verity of fossils belonging to the primordial fauna in any of the rocks of his series. It is a singular fact that, although Mr. E. Davis discovered fossils in the rocks of the Cambrian in 1845, and had re-examined the locality with Mr. Sedgwick in 1846, and announcement of the discovery was made the same year, yet the English geologists did not know, or would not admit, that the primordial fauna of Barrande was contained in the rocks of the Cambrian till 1851, when Barrande visited the Woodwardian Museum, and examined also the collections of the survey; and even then they would not admit it till they had sent some of their own officers over the ground which they had considered finally examined, and these had returned with a convincing collection of primordial fossils.

Barrande's *notice preliminaire* of the primordial fauna of Bohemia was issued in 1846, two or three years after the discovery of primordial fossils in the Taconic, and five years before the discovery of primordial fossils in the Cambrian.

It appears, therefore, that as a formation of rocks, without reference to geological age or relation to other formations, the Cambrian was studied by Sedgwick four years before Emmons began official work on the New York survey; that the term Cambrian was used as a designation for the formation which Sedgwick was engaged on in 1836; and that Emmons used the term Taconic officially first in his volume dated 1842. Emmons was, however, at work incidentally on the Taconic rocks much earlier. Professor Dewey mentions a mineral found by him and analyzed in 1820 (*Am. Jour.*, (i.) ii. 249). Professor Dewey uses the *Taconic range* as a geological entity, and the rocks of the range as a starting-point, in his "Geological Section from Williamstown to the City of Troy," published in 1820. The term

was first used by him in a geological article dated January 27, 1819. Lee, Hitchcock, Emmons, Dewey, Barnes, Briggs, and Eaton, between 1819 and 1842, frequently use the term in their geological papers. They considered the rocks extending from the western towns of Vermont and Massachusetts westward to the Hudson River as constituting a group different from those farther east, and set off by geological distinctions so markedly that they could not be confounded. Sometimes these rocks were referred to as the *rocks of the Taconic range*, sometimes as *transition rocks*, and sometimes as the *metamorphic group*. But that they were a single group, *en masse*, was not questioned, either by the friends or the opponents of the Taconic system, as late as 1844, Eaton having gone so far as to place them below the strata of the New York system.

Used, then, as a datum of geological reckoning, "the rocks of the Taconic range" date from 1819, but it was not till 1842 that Dr. Emmons erected these into a geological group and formally announced the "Taconic System."

The foregoing facts may be tabulated as below:

	Used as a Faunal Designation.	Used in Geological Literature.	Used as Name of a Zone or System.
Primordial	1846	1846	1846
Cambrian	1853	1836	1836
Taconic	1844	1819	1842

In thus calling attention to the use of the term Taconic in geological literature as early as 1819, the objection will naturally arise in the minds of some of the committee that the term was used wholly as a geographic and not as a geological one, and hence that it has no claim in geological nomenclature. While there is some force in this objection, yet, if the nature of the papers written by the earlier geologists be examined into, it will be seen at once that the term was used both in a geographic and in a geological sense. Professor Dewey, in 1820, giving his *geological section from the Taconic range to Troy, N. Y.*, says distinctly that the same rock-formation which constitutes the range at Williamstown extends to the Hoosac Valley, and gives place to a chlorite slate, which, since it is also found in the Taconic range, "ought to be considered as belonging to the range, and as the rock into which the talcose slate passes." From here he continues the section through graywacke rising into the hills at

Petersburg, constituting the mountains of Grafton, and extending as a general rock to Troy, where it is succeeded by a stratum of argillaceous slate, which extends to the banks of the Hudson.

In a general way this group of rocks is referred to as the "metamorphic series," or "transition series," as well as *the rocks of the Taconic range*, by other geologists up to 1842. As a geological designation it had no more force than the terms used by Sedgwick when he referred to the rocks of the Malvern Hills, or of the Longmynd Hills, or the term that was at first used to express the formation of the Helderberg Mountains in New York. In those early days of the century geologists made their designations refer to mineralogical and lithological characters rather than to systematic stratigraphy. Geographic designations had not yet been introduced with the authoritative endorsement of Murchison. There was but imperfect knowledge of systematic stratigraphy; but geographic terms were converted, by an easy scale of varying terminology, into geological terms. The "rocks of the Longmynd" became thus the *Longmynd rocks*. The rocks of the Helderberg Mountains became thus the upper and lower Helderberg rocks; and Mr. Emmons sagaciously chose to erect the rocks of the Taconic range into the Taconic system.

It is customary to date the "Taconic System" from the year 1842, when it was officially announced by Dr. Emmons, and it is just to give the term Taconic its full right as a distinct term in geological nomenclature only after that date, parallel with a similar use of the term Cambrian; but it cannot be questioned that the term Taconic was a semi-geologic term for at least twenty years before.

It may next be asked, What was the intent of the authors of these names? In the absence of perfectly conclusive evidence as to the historic priority of one, in all respects, over the others, when the facts seem to have a divided and variant significance, this may be the only way in which a just conclusion can be reached. It is not necessary to enter upon the citation of facts or quotation of authorities. The following conclusion, so far as Mr. Barrande is concerned, will hardly be questioned. *He worked to elaborate a fauna, and when that was established he denominated the strata the primordial zone.* In doing this he went no farther back than 1846.

In respect to Mr. Sedgwick, he worked on a series of rocks which he thought pertained to a single system, and illustrated it by fossils. These proved to be, for the most part, species of the Bala group, consisting of the second fauna. What few primordial fossils he found he placed within the same fauna. He claimed this fauna and this system of rocks as his Cambrian. This was named in 1836. It was no error of his that subsequently his term was crowded downward and removed from the rocks of the second fauna, and made to cover only a fauna of which he knew nothing. In other words, *the author of the Cambrian intended to include in his system only the rocks containing the second fauna.* Still, his stratigraphic scheme embraced lower beds.

In respect to the intention of Mr. Emmons, he worked on a series of rocks which he claimed was lower than the New York system. He announced a fauna which he intended to illustrate his system. The strata which he included in his system have been proved to contain his alleged fossils, and they pertain to a horizon below the New York system. All rocks known by him to contain fossils of the second fauna occurring within the general Taconic area were exempted by him from the Taconic system. *His main intention, both stratigraphic and palæontologic, therefore, was to include the rocks of the primordial fauna in his system.*

On the question of priority, therefore, the inquiry is reduced to the conflict between Cambrian and Taconic, with the Taconic having two counts to the Cambrian one.

On the question of the relative validity of those counts, the Taconic has that of correctness of palæontological identification and that of use in geological literature, which are very strong, while the Cambrian has that of formal announcement as a system.

On the question of the intention and claim of the author, the Taconic was correct in stratigraphy and palæontology when applied to the *first fauna*, and incorrect when applied by its adversaries to the second fauna. The Cambrian was correct in palæontology, and was not corrected by its author in stratigraphy when applied to the *second fauna*, and is incorrect in both respects when applied by its friends to the first fauna.

If the errors be eliminated, on each side, the first fauna should

be assigned to the Taconic and the second to the Cambrian. This will, of course, require the restriction of the term Silurian to the rocks of the *third fauna*, or to as much of it as was at first covered by that term, as argued by Hunt, Marcou, Rogers, Dawson, Jukes, and others.

The weight of authority and of usage has been in favor of covering the rocks in dispute between Murchison and Sedgwick, so far as they both claim strata holding the second fauna, by the Murchisonian term. Of the merits of this controversy I have nothing to say. It may fairly be left to the English geologists to decide. It would be an easy adjustment of all the conflicting claims, however, to assign, *pro honoris causa*, the first fauna to Emmons, the second to Sedgwick, and the third to Murchison.

THE ARCHÆAN.—It is my individual opinion that no subdivisions of the Archæan can be made, with an approach to probable acceptance and long-continued usefulness, at the present time. It would be judicious to introduce some indeterminate, non-descriptive terms, such as *Archæan No. 1* and *Archæan No. 2*, or *Archæan No. 3*, which could be interpreted by each locality, and applied by the geologists of each country, according to individual preference. In the Northwest, including Wisconsin, Minnesota, and Manitoba, much is now being done on the systematic study in the field of these rocks, and, without saying that the recognized, usual subdivision into Huronian and Laurentian is not valid in very large areas, it is true that, as a general scheme, this simple nomenclature is not applicable. I speak of these rocks as "Archæan" because of the general use of that designation. The terms *azoic* and *eozoic* may have prior rights, and, perhaps, ought to be used instead.

HISTORY OF GARDEN VEGETABLES.

BY E. LEWIS STURTEVANT, A.M., M.D.[1]

(Continued from page 532.)

CATERPILLARS. *Scorpiurus* sp.

A STRANGE taste causes various species of Scorpiurus to be included among our garden vegetables, the caterpillar-like forms of the seed-pods being used as salad-garnishing by those fond of practical jokes. As a vegetable their flavor is very indifferent. The species enumerated by Vilmorin are *Scorpiurus vermiculatus* L., the common caterpillar; *S. muricatus* L., the prickly caterpillar; *S. sulcatus* L., the furrowed caterpillar; and *S. subvillosus* L., the hairy caterpillar. This latter species is figured by Dodonæus in 1616, and is said even then to be sometimes grown in gardens. They are all native to Southern Europe.

CATNIP. *Nepeta cataria* L.

It is hardly worth while to notice this plant of insignificant use, yet still holding a place in the herb-garden, and, in France, grown for use of the leaves as a condiment.[2] In 1726, Townsend[3] says it is used by some in England to give a high relish in sauces. It is a native of Europe, and is now common throughout Eastern America. It is mentioned among the plants of Virginia by Gronovius,[4] as collected by Clayton preceding 1739.

Catnip (called also *Nepp*) has for name, in France, *menthe de chat, herbe aux chats;* in Germany, *gemeines Katzenmunze,*[5] *Nepte;* in Holland, *kattekruid, nept;* in Denmark, *katteurt, sisembrandt;* in Sweden, *kattmynta;* in Italy, *gattaria;* in Spain, *gatera;* in Portugal, *neveda dos gatos;* in Russia, *koschitza mehta.*[6]

CAULIFLOWER. *Brassica oleracea botrytis cauliflora* DeC.

I am unable to recognize the cauliflower in any of the cabbage tribe described by the ancient authors, although the perfected condition of our present vegetable would lead us to assign to it a great antiquity. Its not being mentioned by Ruellius (1536),

[1] Director of the New York Agricultural Experiment Station, Geneva.
[2] Vilmorin, Les Pl. Pot., 1883, 354. [3] Townsend, Seedsman, 1726, 36.
[4] Gronovius, Fl. Virg., 1762, 89. [5] Vilmorin, l. c. [6] Mill. Dict., 1807.

Fuchsius (1542), Roszlin (1550), Tragus (1552), Matthiolus (1558), and others would lead us to infer that it had not yet entered into general European culture. According to Bauhin it is mentioned in the French edition of Dodonæus, 1553 or 1559. The race of cauliflowers owe their peculiarity to a suppression of the floral organs and an abnormal development of the pedicels of the inflorescence. This peculiarity finds recognition in the majority of the names applied in the various languages, as will be observed in the following synonymy:

Brassica florida. Adv., 1570, 91; Ger., 1597, 246, fig.
B. florida botrytis. Lob., Obs., 1576, 123, *cum ic.;* Lob., ic., 1591, i. 245.
B. cauliflora. Cam., Epit., 1586, 252, *cum ic.;* Matth., 1598, 367, *cum ic.;* Dod., 1616, 624, *cum ic.;* Bauh., Pin., 1623, iii.; Bodæus a Stapel, 1644, 776, *cum ic.*
B. pompeiana, B. cypria. Lyte's Dod., 1586, 636.
B. pompeiana aut cypria, B. florida dodo. Lugd., 1587, 522, *cum ic.*
B. cypria sive pompeiana, vulgo caulifiori. Cam., Hort., 1588, 29.
B. cauliflora, pompeiana plinio. Bauh., Phytopin., 1596, 177.
Bradica florida. Cast., Dur., 1617, ap. *cum ic.*
B. multiflora. J. Bauh., 1651, ii. 829, *cum ic.;* Chabr., 1677, 269, *cum ic.*

The vernacular names earliest recorded are mostly founded upon the bloom, and may be translated flowering-cabbage. In the English name used by Lyte in 1586 we have a source of origin indicated, as *Cypress coleworts.* Dalechampius likewise, in 1587, gives one French name as *Chou de Cypre.* Pierres Pompes, a French author of 1694, is quoted by Phillips as saying about the cauliflower, "It comes to us in Paris, by way of Marseilles, from the isle of Cyprus, which is the only place I know of where it seeds." Strange, indeed, it is to find, at a date as remote as 1565, the cauliflower to be reported as abounding at Hayti, in the New World,[1] at a date preceding nearly all our recorded mentionings. It was, however, a well-known and carefully-cultivated plant in France in 1612, if we may trust "Le Jardinier Solitaire." Rauwolf,[2] who travelled through the Orient in 1573–75, found the Caulifiore at Aleppo. In England it is figured by Gerarde in 1597, and must have been known to Lyte in 1586,

[1] Benzoni, Hist. of the New World, Hak. Soc. Ed., 91.
[2] Gronovius, Fl. Orient., 1755, 81.

as he gives an English name,—*flowrie cole*, or *Cypress colewoorts;* but, according to Parkinson, it was rare in 1629. In 1683, Worlidge praises them greatly. According to Heuze,[1] three varieties of cauliflowers were described by Ibn-al-awan for the Nabathean agriculture in Spain in the twelfth century.

In 1778, Mawe[2] mentions for varieties only the early and the late, scarcely differing. In 1806, in America, McMahon[3] knew the same only, and but two varieties are named by Bridgeman[4] in 1832. In France, in 1824,[5] three varieties—*le dur*, *le demi-dur*, and *le tendre*—are named, and the same in 1829.[6] In 1883, Vilmorin[7] describes sixteen sorts; and Burr[8] describes ten sorts for America in 1863.

The varieties of the cauliflower are essentially of one type, although some are more highly improved than others; and there are differences in size, height, and season, one kind even being purplish in the head. The distinctions are, however, not highly constant, and variations found in the growing serve to bridge whatever chasms may appear; and hence we may conclude that the varieties are but due to seminal variation carefully selected.

The names given to the *cauliflower* in various countries are: in France, *Choux-fleurs;* in Germany, *Blumenkohl*, *Carfofil;* in Flanders and Holland, *bloemkool;* in Denmark, *blomkaal;* in Italy, *cavol-fiore;* in Spain, *Coliflor;* in Portugal, *Couve flor;*[9] at Constantinople, *karnabiti;*[10] in India, *phool kobee*.[11]

CELERIAC.[12] *Apium graveolens* L., *var. rapaceum* DeC.

This vegetable is described by Gray[13] as a state of the common celery in which the root is enlarged and eatable. It presents but

[1] Heuze, Les Pl. Alimen., i. p. iv.
[2] Mawe, Gard., 1778.
[3] McMahon, Am. Gard. Kal., 1806.
[4] Bridgeman, Young. Gard. Assist., 1832.
[5] L'Hort. Fran., 1824.
[6] Noisette, Man., 1829.
[7] Vilmorin, Les Pl. Pot., 1883.
[8] Burr, Field and Gard. Veg., 1863.
[9] Vilmorin, Les Pl. Pot., 1883, 144.
[10] Forskal, Fl. Ægypt.-Arab., xxix.
[11] Speede, Ind. Handb. of Gard., 1842, 116.
[12] Since writing the above I have come into possession of Porta's Villæ, lib. xii., 1592, and on page 686 he speaks of the *Apium capitatum* as found in the gardens of St. Agatha, Theano, and elsewhere in Apulia, taken from nature, and as unnoticed and unnamed by the ancients. He describes the bulb as being of the size of the human head, and of a sweet, odorous, and grateful taste. He also implies the beginnings of an unsuccessful culture elsewhere.
[13] Gray, Field, Forest, and Gard. Bot., 165.

few varieties,—one with a rough root, one with a globular, smooth root, one with variegated leaves, and a fourth which is very much dwarfed. Other varieties are named, but the differences are very unessential. In French works on gardening of 1826 and 1829,[1] the white and the red, the latter described as with the bulb veined with red or violet, are mentioned, together with a sub-variety with a round root.

In 1536, Ruellius,[2] in treating of the ache or uncultivated *smallage*, as would appear from the context, says the root is eaten, both raw and cooked. Rauwolf,[3] who travelled in the East (1573–75), speaks of *Eppich*, whose roots are eaten as delicacies, with salt and pepper, at Tripoli and Aleppo; and J. Bauhin,[4] who died in 1613, mentions a *Selinum tuberosum, sive Buselini speciem*, as named by Honor. Bellus, which seems to be the first mention of the true celeriac that I find, as the earlier references quoted may possibly refer to the root of the ordinary sort; although I think not, for at this date the true celery had scarcely been sufficiently developed. In 1729, Switzer[5] describes the plant in a book devoted to this and other novelties, but adds that he had never seen it; and this indicates it was little known in England at this date, for he adds that the gentleman, who had long been an importer of curious seeds, furnished him with a supply from Alexandria. It is again named in England in 1752,[6] 1765,[7] and by succeeding writers, but is little known even at the present time. It is described by McMahon[8] for American gardens in 1806. In France and Germany it is commonly employed as a vegetable and as a salad. It is even cultivated in the Mauritius.[9]

Celeriac, or *turnip-rooted celery*, is called, in France, *celeri-rave;* in Germany, *Knoll-Sellerie;* in Flanders and Holland, *Knoll-Selderii;* in Denmark, *Knold-Selleri;* in Italy, *sedano-rapa;* in Spain, *apio-nabo, apio-rabano.*[10]

[1] Petit, Dict., 1826; Noisette, Man., 1829.
[2] Ruellius, De Nat. Stirp., 1536, 708.
[3] Gronovius, Orient., 1755, 35.
[4] J. Bauhin, Hist., 1651, iii. pt. 2, 101.
[5] Switzer, Method of Raising . . . Celeriac, etc., 1729, 9.
[6] Mill. Dict., 1752; ex. Mill. Dict., 1807.
[7] Stevenson, Gard. Kal., 1765, 30.
[8] McMahon, Am. Gard. Kal., 1806.
[9] Bojer, Hort. Maur., 1837, 158.
[10] Vilmorin, Les Pl. Pot., 76.

Celery. *Apium graveolens* L.

I have previously given the history of celery in the American Naturalist for July, 1886. I can add only a few references to those therein given. "Le Jardinier Solitaire" (1612) gives directions for the cultivation of "Celery" in France, and Mentzel[1] gives the word "Sellerrey" in Belgium, and "Sellerey oder Aeppich" in Germany, with "Tabernæmontanus" as a reference. Now, one edition of "Tabernæmontanus" was published in 1588, and if this reference be correct we are able to carry the use of the word *celery* into the sixteenth century. Albertus Magnus,[2] who lived in the thirteenth century, evidently speaks of the wild plant when he calls it aquatic, but describes characters which apply to the smallage by adding that it has a concave foot-stalk, recumbent and white.

In China, at the present time, the name of celery is *Ch'in ts'ai*.[3]

Chard. *Beta vulgaris* L.

The chard was the Beta of the ancients and of the middle ages. The red chard was noticed by Aristotle[4] about 350 B.C. Theophrastus[5] knew two kinds,—the white, called Sicula, and the black (or dark green), the most esteemed. Dioscorides[6] also records two kinds. Eudemus, quoted by Athenæus[7] (the second century), names four,—the sessile, the white, the common, and the dark, or swarthy. Among the Romans the chard finds frequent mention, as by Columella,[8] Pliny,[9] Palladius,[10] Apicius,[11] etc. In China it was noticed in writings of the seventh or eighth century, the fourteenth, sixteenth, and seventeenth centuries;[12] in Europe, by all the ancient herbalists.

The chard has no Sanscrit name. The ancient Greeks called

[1] Mentzel, Index Nominum, 1682, 30.
[2] Albertus Magnus, De Veg., Jessen ed., 1867, 480.
[3] Gard. Chron., July 10, 1886, 41.
[4] Aristoteles, Scaliger's ed., 1566, 69.
[5] Theophrastus, Bodæus a Stapel ed., 1644, 778.
[6] Matthiolus, Comment., 1558, 248.
[7] Quoted from Turre, Dryadum, etc., 1685, 442.
[8] Columella, lib. x. c. 251; lib. xi. c. 3, etc.
[9] Pliny, lib. xix. c. 40.
[10] Palladius, lib. iii. c. 24; iv. 9; v. 3; vi. 4; viii. 2.
[11] Apicius, lib. iii. c. 2, ii.
[12] Bretschneider, Bot. Sin., 53, 59, 79, 83.

the species *teutlion;* the Romans, *beta;* the Arabs, *selg;* the Nabathean, *silq.*[1] Albertus Magnus,[2] in the thirteenth century, uses the word *acelga,*—the present name in Portugal and Spain. The modern names are: French, *poirée;* German, *Beisskohl, Beete, Mangold;* Flanders and Holland, *snij beet;* Denmark, *blad bede;* Italy, *bieta befitola;* Spain, *bleda* and *acelga;*[3] in China, *tien ts'ai.*[4]

The wild form—*Beta maritima* L.—is found in the Canary Isles, the whole of the Mediterranean region as far as the Caspian, Persia, and Babylon; perhaps even in Western India,[5] as also about the sea-coasts of Britain.[6] It has been sparingly introduced into kitchen-gardens for use as a chard.[7]

The red, white, and yellow forms are named from quite early times; the red by Aristotle, the white and dark green by Theophrastus and Dioscorides. In 1596, Bauhin[8] names the dark, the red, the white, the yellow, the beet with a broad stalk, and the sea-beet. These forms, while the types can be yet recognized, yet have changed their appearance in our cultivated plants, a greater compactness and development being noted as arising from the selection and cultivation which has been so generally accorded in recent times.

Vilmorin describes for varieties the white, the Swiss, the silver, the curled Swiss, and the Chilian chards. To this we may add less improved forms, such as the sea-beet.

Sea-Beet.

Beta sylvestris spontanea marina. Lob., Obs., 1576, 125.
B. sylvestris maritima. Bauh., Phytopin., 1596, 191.
Sea-Beet. Ray, Hist., 1686, i. 204.

The leaves form an excellent chard, and in Ireland are collected from the wild plant and used for food,[9] and in England the plant is sometimes cultivated in gardens.[10] This form has been ennobled by careful culture, continued until a mangold was obtained.[11]

[1] De Candolle, Orig. Des Pl. Cult., 47.
[2] Albertus Magnus, De Veg., Jessen ed., 1867, 8.
[3] Vilmorin, Les Pl. Pot., 1883, 420.
[4] Gard. Chron., July 10, 1886, 41.
[5] De Candolle, l. c., 46.
[6] Lindley, Morton's Cyc. of Ag., i. 234.
[7] Targioni Tozetti, Hort. Trans., 1854, 147.
[8] Bauhin, Phytopin., 1596, 190.
[9] Johnson, Useful Pl. of Gt. Brit., 214.
[10] Lindley, Morton's Cyc. of Ag., i. 234.
[11] Agr. Gazette, September 8, 1879, 218.

WHITE, OR COMMON BEET.

Beta alba lactucæ & rumicis folio, etc. Adv., 1570, 93.
B. alba vel pallescens, quam Cicla officin. Bauh., Pin., 1623, 118.
White Beet. Ray, 1686, 204.
Beta cicla. L., Sp., 1774, 322.
Common White-Leaved. Mawe, 1778.
White-Leaved. McMahon, 1806, 187.
Spinach-Beet. Loudon, 1860.
Poirée blonde ou commune. Vilm., 1883, 421.

This beet, a native of Sicily, near the sea-coast, as well as the shores of Spain and Portugal, was introduced into England in 1570.[1] It seems closely allied to the Swiss chard.

SWISS CHARD.

Beta alba? 3. Gerarde, 1597, 251.
The Sicilian Broad-Leaved Beet. Ray, 1686, 205.
White Beet. Townsend, 1726.
Chard, or Great White Swiss Beet. Mawe, 1778.
Swiss, or Chard Beet. Mill. Dict., 1807.
Swiss Chard, or Silver Beet. Buist, 1851.
Silver-Leaf Beet. Burr, 1863, 292.
Poirée à carde blanche. Vilm., 1883, 421.

This is deemed by Ray to have been known to Gerarde (1597), for Gerarde, in his "Herbal," indicates the sportive character of the seed as to color, and mentions a height which is only attained by this plant. He calls it "3 . . . another sort hereof that was brought unto me from beyonde the seas," and particularly notices the great breadth of the stalk; but the color particularly noticed is the red sort. Ray gives as a synonyme *Beta italica* Parkinson, 1629 or 1640. It is quite variable in the stalks, according to the culture received.

SILVER-LEAF BEET.

Poirée blonde à carde blanche. Vil., 1883.

A lighter green form of the Swiss chard, as described by Vilmorin, but with shorter and much broader stalk. It seems to be a variety within the changes which can be effected by selection and culture, and perhaps can be referred to the Chilian type.

[1] Booth, Treas. of Bot.; Loudon, Hort.; McIntosh, Book of the Gard., ii. 139.

Curled Swiss Chard.

Curled-Leaf Beet. Burr, 1863, 291.
Beck's Seakale Beet. Gard. Chron., 1865.
Poirée à carde blanche frisée. Vilm., 1883.

Evidently a form of the Swiss, the stalks broader, the leaves blistered and curled.

Chilian Beet.

This form is usually grown for ornamental purposes, for which they are very efficient. The stalks are often very broad and twisted, and the colors very clear and distinct, the leaf puckered and blistered as in the Curled Swiss. In the *Gardeners' Chronicle*[1] (1844) it is said that these ornamental plants were introduced to Belgium some ten or twelve years previously. "It is yellow or red, and varies in all the shades of these two colors." In 1651 J. Bauhin[2] speaks of two kinds of chard as novelties,—the one, white, with broad ribs; the other, red. He also speaks of a yellow form, differing from the kind with a boxwood-yellow root. In 1655, Lobel[3] describes a chard with yellowish stems, varied with red. The forms now found are described by their names: Crimson-Veined Brazilian, Golden-Veined Brazilian, Scarlet-Ribbed Chilian, Scarlet-Veined Brazilian, Yellow-Ribbed Chilian, Red-Stalked, etc.

The modern chards are the broad-leaved ones, and all must be considered as variables within a type. This type may be considered as the one referred to by Gerarde in 1597, whose "seedes taken from that plant which was altogether of one colour and sowen, doth bring foorth plants of many and variable colours." Our present varieties now come true to color in most instances, but some seed furnish an experience such as that which Gerarde records. It seems plausible that *B. maritima* L. is the parent form of the narrow-ribbed varieties, while *B. sicla* L. is the parent of the broad-stalked forms, and, judging from analogy, as well as by the descriptions of the wild plant, the prototypes of all the colors, and the smooth and blistered-formed leaves, probably can be found in nature.

[1] Gard. Chron., 1844, 591.
[2] J. Bauhin, Hist., 1651, ii. 961.
[3] Lobel, Stirp. Illust., 1655, 84.

Chervil. *Scandix cerefolium* L.

The leaves of chervil are aromatic, and are much used in England for seasoning and in salads.[1] It was mentioned as cultivated by Columella, Pliny, and Palladius, Roman authors of the first and third centuries. It also finds description as a cultivated plant in the botanies of the sixteenth century. It was in American gardens in 1806.[2] But two varieties are now in use, —the plain-leaved and the curled,—and these are mentioned by Petit[3] in France in 1826; and yet chervil is noted as one of the most widely diffused and best known of all pottage plants.[4]

Chervil is called, in France, *Cerfeuil;* in Germany, *Kerbel;* in Flanders and Holland, *Kervel;* in Denmark, *havekjowel;* in Italy, *cerfoglio;* in Spain, *perifollo;* in Portugal, *cerefolio.*

Chick-Pea. *Cicer arietinum* L.

This vegetable is a favorite with southern nations, and finds occasional culture among the recent emigrants to the United States, or by their descendants. While not grown on a large scale in the United States, it forms an article of extended culture in the Iberian peninsula,[5] and in India,[6] Egypt, Greece, etc.[7] The shape of the seed, singularly resembling a ram's head while in an unripe state, may account for its being regarded as unclean by the Egyptians of the time of Herodotus.[8] It was in common use in ancient Rome, and varieties are mentioned by Columella[9] and Pliny,[10] the latter naming the white and the black, the Dove, or Venus pea, and many kinds differing from each other in size. Albertus Magnus,[11] in the thirteenth century, mentions the red, the white, and the black sorts, and this mention of colors is continued by the herbalists of the sixteenth, seventeenth, and eighteenth centuries. The white chick-pea is the sort now generally grown in France, where the dried seed find large use in soups. The red variety is now extensively grown in the Eastern countries, and the black sort is described as more curious than useful.

[1] Vilmorin, The Veg. Gard., 1885, 192.
[2] McMahon, Am. Gard. Kal., 1806.
[3] Petit, Dict. du Jard., 1826.
[4] Vilmorin, Les Pl. Pot., 78.
[5] Gasparin, Cours d'Agr., iii. 796.
[6] Elliot, Bot. Soc. of Edinb., vii. 294.
[7] Unger, U. S. Pat. of Rept., 1859, 317.
[8] Pickering, Geog. Dist. of An. and Pl., 41.
[9] Columella, lib. ix. c. 1.
[10] Pliny, lib. xviii. 32.
[11] Albertus Magnus, De Veg., Jessen ed., 1867, 490.

Under the hot climate of India the plant secretes an acid, which the natives collect by spreading a cloth overnight on the plant and wringing out the dew in the morning; this they use for vinegar or for forming a cooling drink.

The multitude of the vernacular names of the chick-pea, and their distribution, indicate the presence of numerous varieties and an extended use. The European names are, in English, *chick-pea, Egyptian pea, horse-gram,* [in India] *Bengal gram;* in France, *pois chiche, garvance, café français, ceseron, cicerolle, ciseran, garvane, pisette, pois becu, pois blanc, pois ciche, pois cornu, pois de brebis, pois gris, pois pointu, pois de Malaga, tête de bélier;* in Germany, *Kitchererbse;* in Italy, *cece;* in Spain, *garbanzos;* in Portugal, *chicaro, grao de bico;* in Greece, *hrobithi.*

In the extra European countries it has received, among others, the following names: in Arabic, the green-seeded sort, the plant, *malaneh;* the dry seed, *homos,*[1] *hims,*[2] *al-koular;*[3] in Bengali, *chala, boot, chuna-batoola,*[2] *boot-kaley;*[4] in Egypt, *homos;*[2] in Hebrew, *ketsech;*[3] in Hindustani, *but, hurbury, chenna;*[2] in Malay, *kadala;*[4] in Persia, *nakhuda;*[5] in Sanscrit, *chanaka, sanakha, harimanthaka;*[5] in Tamil, *cadalie,*[2] *kadalai;*[5] in Telegu, *senegaloo,*[4] *senegalu, senaga;*[5] in Burmah, *ku-lu-bai.*[6]

Chickling Vetch. *Lathyrus sativus* L.

This in many regions is rather a forage-plant than a vegetable;[7] but in the south and southwest parts of Europe, as in Italy and Spain, and also in Turkey[8] and India,[9] as well as elsewhere, it is grown for the use of the seed in soups, etc.,[10] as well as in the manner of green peas.[11] It has been cultivated in Southern Europe from a remote period, and finds mention by Columella[12] and Palladius.[13] According to Heuze,[8] it came from Spain into France in 1640; but this must refer to some variety, for it appears to have been well known to the herbalists of the sixteenth century, as by Dodonæus[14] in 1556, and others. It was included among American vegetables by Burr in 1863, who

[1] Delile, Fl. Ægypt, illust.
[2] Birdwood, Veg. Prod. of Bombay, 118.
[3] Heuze, Les Pl. Alim., ii. 473.
[4] Drury, Useful Pl. of Ind., 134.
[5] Elliot, Bot. Soc. of Ed., vii. 204.
[6] Pickering, Ch. Hist., 183.
[7] Decaisne and Naudin, Man., iv. 316.
[8] Heuze, Les Pl. Alim., ii. 414.
[9] Birdwood, Veg. Prod. of Bomb., 120.
[10] Bon Jardinier, 1832, 603.
[11] Noisette, Man., 1860, ii. 377.
[12] Columella, lib. ii. c. 11.
[13] Palladius, lib. iv. c. 6.
[14] Dodonæus, Frument., 1556, 113.

mentions two varieties,—the one with dun, the other with white, seeds. This latter form was mentioned by Bauhin in 1623.

The European names are, in France, *gesse cultivée, gesse blanche, lentille d'Espagne, dent-de-brebis, pois breton, pois carre;* in Germany, *essbare Platterbse, weisse Platterbse, deutsche Kicher;* in Flanders, *platte erwt;* in Holland, *peul erwt, wiken;* in Spain, *arveji;* in Spanish America, *muelas;*[1] in Italy, *cicerchia-cichero.*[2]

In extra European languages: in Bengali, *khesaree, teora;* in Egypt, *gilban;* in Guzerat, *lang;* in Hindustani, *kussoor;* in Persian, *masang;* in Sindh, *matar.*[3]

Chicory. *Cichorium intybus* L.

The wild chicory has been used for time immemorial as a salad-plant, and, forced in darkness, affords the highly-esteemed vegetable in France known as *barbe-de-capuchin.* It has also large-rooted varieties, and these, when treated in like manner, form the vegetable known in Belgium as *witloof.*

Whether the chicory was cultivated by the ancients I think there is reason to doubt, although they knew the wild plant and its uses as a vegetable. It is not mentioned in the descriptive list of garden vegetables in use in the thirteenth century, as given by Albertus Magnus.[4] Ruellius,[5] in 1536, mentions two kinds, but does not imply cultivation; nor does Fuchsius,[6] in 1542, who likewise names two kinds, one of which is our dandelion. It is treated of by Tragus,[7] in 1552; Matthiolus,[8] 1558; the "Adversaria,"[9] 1570; Lobel,[10] 1576; Camerarius,[11] 1586; Dalechampius,[12] 1587; Gerarde,[13] 1597; but no mention of cultivation. Although not mentioned in Lyte's translation of Dodonæus (1586) as cultivated, yet in Dodonæus's "Pemptades" (1616) it is said not only to occur wild throughout all Germany, but to be cultivated in gardens; and this is the first mention of culture that I note. In 1686, Ray[14] says it is sown in gardens and occurs wild in England, and the seed occurs among seedsmen's supplies in 1726.[15]

[1] Vilmorin, Les Pl. Pot., 1883, 241.
[2] Birdwood, l. c.
[3] Heuze, l. c.
[4] Albertus Magnus, lib. vii. tract ii. c. 2.
[5] Ruellius, De Nat. Stirp., 1536, 495.
[6] Fuchsius, De Stirp., 1542, 679.
[7] Tragus, 1552, 272.
[8] Matth., Com., 1558, 258.
[9] Pena and Lobel, Adv., 1570, 82.
[10] Lobel, Obs., 1576, 114.
[11] Camerarius, Epitome, 1586, 285.
[12] Hist. Gen., Lugd., 1587, 557.
[13] Gerarde, Herbal, 1597, 235.
[14] Ray, Hist., 1686, i. 255.
[15] Townsend, Seedsman, 1726, 33.

At the present time chicory is grown for the use of its leaves in salads, and for its root to be used as an adulterant for coffee. The smooth, tapering root, which seems such an improved form in our modern varieties, is beautifully figured by Camerarius in 1586. The common chicory grown for salads is but the wild plant little changed, and with the divided leaves as figured by the herbalists. The entire leaved form, with also a tendency to a red midrib, also occurs in nature, and may be considered as the near prototype of the Madgeburg large-rooted, and of the red Italian sorts. The variegated chicory, the curled-leaved, and the broad-leaved may have their prototypes found in nature if sought for, but at present must remain unexplained. We may remark, however, that variation in nature is of very common occurrence, and quote from Vilmorin[1] that M. Jacquin has fixed from the wild sort varieties, which he has named the *demi-fine; demi-fine à feuilles jaunes; demi-blonde, forme de laitue pommee; brune, forme de laitue pommee.* These varieties are not now, however, in gardens. The common, the spotted-leaved, and the large-rooted were in French culture in 1826.[2]

The chicory, or succory, is called, in France, *chichoree sauvage, chicorée amère, chicorée barbe de capucin;* in Germany, *wilde* or *bittere Cichorie;* in Denmark, *Sichorie;* in Italy, *cicoria selvatica, radicchio radicia;* in Spain, *Achicoria amarga o agreste;* in Portugal, *chicoria;* in Arabic, *hinduba, Shikorieh,*[3] *Chikourieh;*[4] in Persia, *Kasnee;*[3] at Constantinople, *korla*[5] by the Greeks; in Japan, *kio, tsisa.*[6]

[1] Vilmorin, Les Pl. Pot., 1883, 101; The Veg. Gard., 1885, 199.
[2] Petit, Dict. du Jard., 1826.
[3] Birdwood, Veg. Prod. of Bomb., 49
[4] Maillet, Desc. de l'Egypt, 1735, 12.
[5] Forskal, Fl. Ægypt.-Arab., xxx.
[6] Thunberg, Jap., 304.

(To be continued.)

CONVENTIONALISM IN ANCIENT AMERICAN ART.

BY J. S. KINGSLEY.

THE paper recently published by Prof. F. W. Putnam, under the above title,[1] is a nice piece of archæological and artistic research. The complete paper is a short one, the points being brought out by the illustrations rather than by the description in the text, of which the following is a rather full abstract. It is, however, but just to say that the full series of illustrations elucidate the points far more completely than the few which are reproduced here.

The evolution of the ceramic art itself is an oft-told tale,—first, the clay-lined basket, and, last, the potter's wheel. The ordinary savage ornament is also well known; but occasionally one runs across, even in the pottery of the American aborigines, examples where the potter has the true artistic spirit. He has first taken a realistic representation of some familiar form, and adapted it to the vessel in hand. In course of time, as Professor Putnam says, as art increased power of expression, it progressed beyond mere realism and led to the representation of an object by certain conventional characters, without that close adherence to nature which was at first necessary to a clear understanding of the idea which was intended to be conveyed. Our author was led to a study of this conventionalism by the long series of pottery contained in the Museum of American Archæology and Ethnology at Cambridge, from the stone graves of the Cumberland Valley, in Tennessee, and the burial mounds of Missouri and Arkansas. The extent of these collections can be realized when it is said that they were derived from over six thousand of the stone graves and almost innumerable mounds, all examined in the most thorough and scientific manner. This study led to an examination of the other pottery in the museum, and it was found that a similar conventionalism was wide-spread, though not universal, and that similar artistic results by no means implied community of descent or even contact of the tribes.

To illustrate the points involved, we would first call attention

[1] Bulletin of the Essex Institute, vol. xviii., 1887.

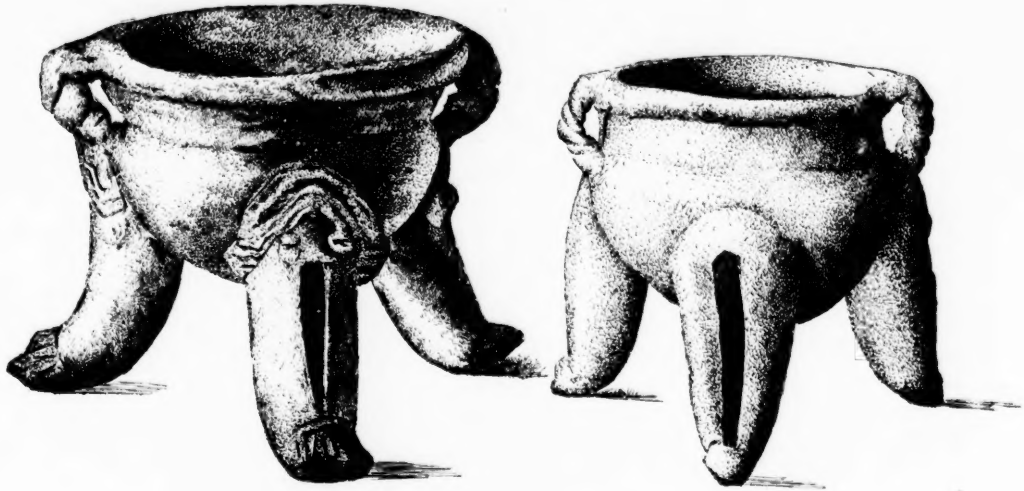
to the three-legged kettles or tripods from the ancient graves in Chiriqui, Panama, of which the museum possesses an extensive series, two of which are represented in Plate XXIV. It is well known that the primitive clay pot had a round bottom, and, to prevent this from overturning, it was propped up on stones. It marked a step in advance when the support was transferred to

FIG. 1.

FIG. 2.

the kettle itself by the addition of legs, as represented in the right-hand figure of the plate referred to. Here was a chance for the artist, and, realizing the adaptability of these legs to the reproduction of the form of a fish, he availed himself of it, as shown in the figure at the left. On each of the feet of the latter we see the wide and projecting mouth, the eyes, the pectoral

PLATE XXIV.



fins, and a forked tail. The place where the dorsal fin would naturally come was cut away before baking, so as to prevent cracking. It is noticeable that in all the specimens there is no attempt to represent the anal fin, which normally should be on the opposite or inner side of the leg.

In Figs. 1 to 4 four legs from similar pots are represented in order to show the development of the conventional idea of a fish, and especially of the dorsal fin, from a realistic representation. It should be said that a fuller series of illustrations would make

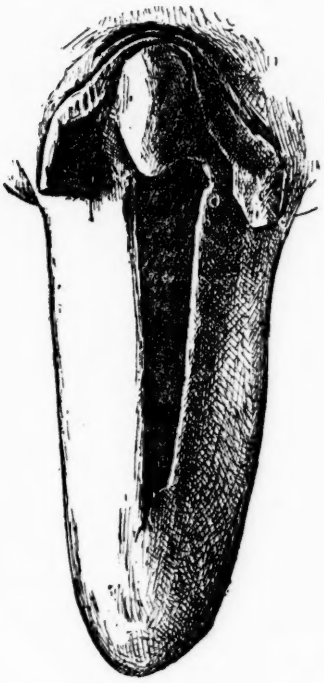


FIG. 3.

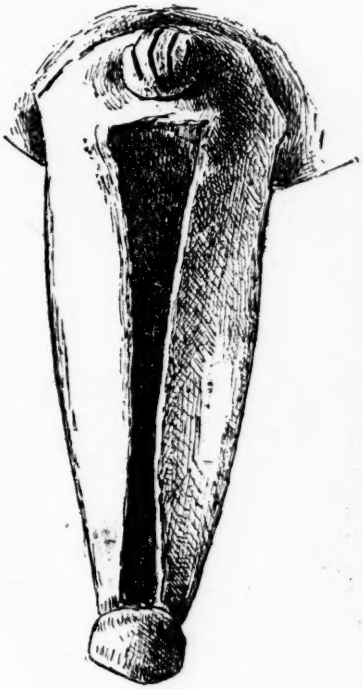


FIG. 4.

the transitions less marked. In Fig. 1 we have a highly realistic repre- ation of a fish, in which mouth, eyes, pectoral fins, and ta.. ... ell shown, while the dorsal fin is crowded to a position in front of the eyes,—a conventional position adopted from the necessities of those legs where the slit was in the position where

the fin really would be. Here, too, the tail has become conventionalized, while the ventrals are wanting. In Fig. 2 the ventrals are shown, and the mouth, with its armature of teeth. Here, however, necessity and artistic license have stepped in, and the dorsal fin is now forced into the mouth itself, while the eyes have disappeared. In Fig. 3, though the dorsal is more nearly

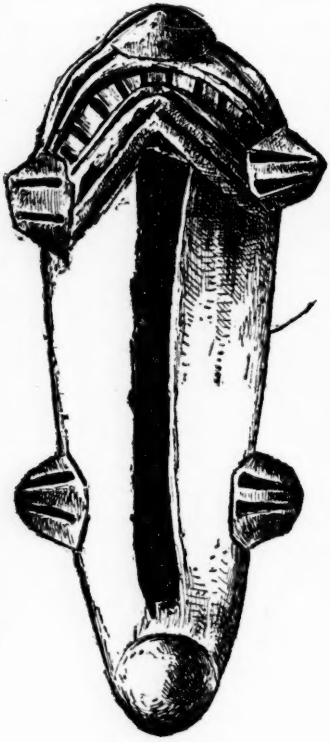


FIG. 5.

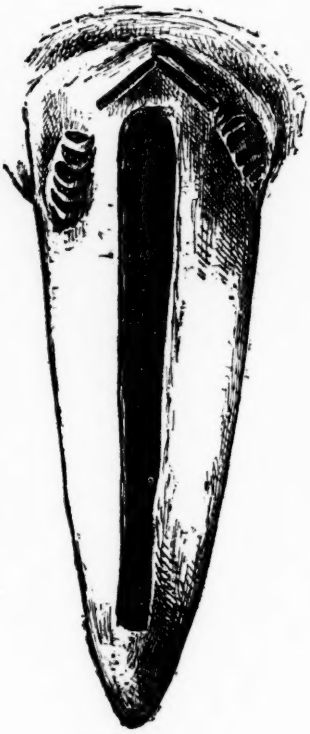


FIG. 6.

in its proper place, the conventionalism has gone further, and only a rude mouth remains to show the fish. The series reaches its extreme in Fig. 4, where all but the dorsal fin have disappeared, and yet the fact is evident, from a comparison of the series, that a fish was meant, though reduced to its simplest conventional form.

In the series represented in Figs. 5 to 8 the conventional evolution of the mouth is shown. In Fig. 1 we have the realistic mouth, but in Fig. 5 a second, beak-like mouth has been inserted in advance of the regular mouth, with its armature of teeth. Behind the true mouth are deep lines cut in the clay, as if to

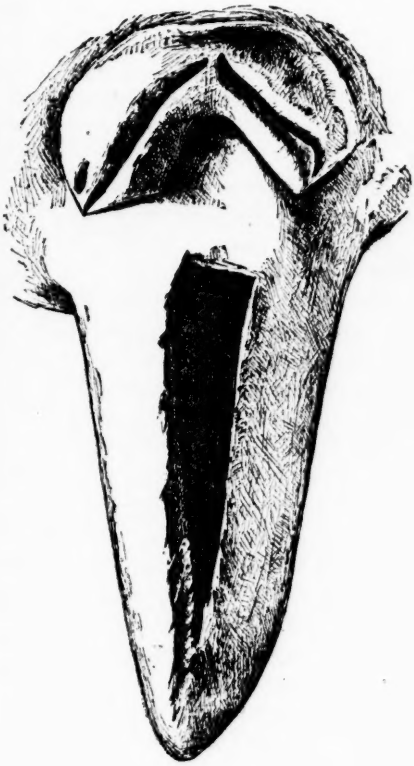


FIG. 7.

FIG. 8.

give emphasis to the jaws. The pectoral and ventral fins are still of a realistic type, but the caudal is represented by a rounded knob. In Fig. 6 the mouth is represented by a projecting mass of clay above the opening in the foot, in which are deep lines corresponding to those of the last figure, while the grooved patch on either side of the opening represents the pectoral fins.

All other features have disappeared. In the next figure the pointed jaw alone is retained in the mass of clay above the opening, and in the last figure (Fig. 8) the climax of this conventionalism is reached, where all that remains of the fish consists in two pairs of oblique lines representing the jaws.

These prehistoric people of Chiriqui carved in stone as well as in clay, and were remarkable for their work in copper and gold. In all these materials similar realism and a similar development of the conventional can be traced. Other animals, even the human form, are thus treated; but in the museum collections the series of fish forms is the largest and most perfect, and hence was selected for illustration.

In the stone graves of Tennessee a similar evolution is observable. First, we have a rudely realistic representation of an animal-head upon the sides of the pot; but this has resulted in an unsymmetrical form. This was improved by the addition of knobs, which might be called nose and tail, and afterwards by handles. In the mean time conventionalism steps in, and the features, which once were highly realistic, become represented by six round knobs of equal size, and realistic work has entirely given way to symmetry, and a common cooking-pot has become chaste in style as a result of a development of artistic feeling. A somewhat similar development is traced in the ancient pottery of Nicaragua, and the result is much the same. In specimens from Arkansas the fish-like form is conventionalized upon the pot itself, and either the head and tail or the dorsal and anal fins alone remain as handles. Again, the frog was similarly treated; as were the bird, human figure, and squash. From an examination of the collections in the museum it would be easy to conclude that the jars in the shape of a woman were evolved from the squash-like form, were it not, as Professor Putnam says, that the realistic precedes the conventional in every instance.

As was said above, this conventionalism does not occur among all the peoples of ancient America. In ancient Mexico, for instance, the higher ceramic art was symbolical rather than conventional. So, too, the ancient Peruvians west of the regions influenced by the Aymaras, or their predecessors in the region of Lake Titicaca, were lacking in conventionalism, and their highest art was a realistic one, in which was often added an expression of action. In the region of Lake Titicaca another

type of art-expression existed, which seems to show a remarkable resemblance to those Old-World forms which reached its culmination in the classical type of the Mediterranean peoples.

A study of these features of ceramic art enables us to draw many interesting and important conclusions. At times, as in the case of the reappearance of the same forms similarly treated in the stone graves of Tennessee and the mounds of Missouri and Arkansas, we are led to the view that they had, at least, a point of contact. In other instances we have evidence of migrations, while, again, in other cases, where both contact and migration are out of the question, we are able to trace the development of that innate principle of the human mind which, among all peoples, finds its expression in ornament and art. We see that the artistic powers of man, like the languages, were developed in distinct centres, and from primitive forms of expression, which, of necessity, had principles in common; and this will amply account for the reappearance of the same forms in widely-separated regions. The early methods of ornamentation of pottery were by finger-marks, scratches, cross-lines, and the impression of cords and fabrics, and these are found almost the whole world over. It is only when steps in advance are taken that the art of each nation receives its distinctive impress.

COMPARATIVE CHEMISTRY OF HIGHER AND LOWER PLANTS.[1]

BY HELEN C. DE S. ABBOTT.

ON coming before a popular audience to present a special subject like Plant Chemistry, I do so in hopes perhaps of showing some of the less familiar sides of plant-life. The chief idea of the remarks I am about to make is one that has not occupied to any great extent the minds of botanists and chemists, and if it be not true, at least, no other hypothesis has been suggested than the one I will indicate to account for the chemical compounds of the vegetable kingdom.

[1] Lecture delivered in the course given under the auspices of the Philosophical, Anthropological, and Biological Societies in the United States National Museum, Washington, April 23, 1887.

On past occasions[1] I have spoken of certain chemical compounds in relation to plant morphology and evolution. The facts then advanced tended to show a chemical progression in plants, and a mutual dependence between chemical constituents and change of vegetable form, and in the following pages I will keep this idea prominently before you.

Certain condensations of force on our planet are known as chemical bodies. By usual methods they cannot be split up into component parts, hence are denominated elements. However, we have reason to believe that these so-called elements are in reality compounds themselves, formed in the cosmic laboratory from still simpler aggregations of matter.

In mineralogy the series of chemical formations are doubtlessly the result of evolution, from the more simple elements to the complex structure of the crystalline rocks.[2]

The plant kingdom may be considered as a third and higher stage; it contains in its structure combinations of the elements carbon, hydrogen, nitrogen, oxygen, sulphur, phosphorus, and compounds derived from the mineral world.

The essence which underlies all force and life may be traced through these three planes as a law of progression, little varying in its general course, though ever giving more involved problems for solution, according to the increasing complexity, from elements and minerals to plants, and even to animals.

The line separating each of these conditions of matter is indistinct, "the individual of the one encroaches upon the dominion of the other;"[3] as a spiral coil is of a single thread, so "nature in all her manifestations constitutes a unity,"[4] and the rounds of the spiral present each stage parallel, but in reality a continuation.

Analogies should not be given too much weight, but from numerous facts the above statements seem theoretically reasonable and may be provisionally accepted. The possibility of chemical evolution of the elements, in itself, is not only one of the most

[1] "Certain Constituents of Plants considered in Relation to their Morphology and Evolution." Read before the Chem. Sec. of the A. A. A. S. at Buffalo, 1886. Abstract published in the *Botanical Gazette*, vol. xi., October, 1886. "The Chemical Basis of Plant Forms." Lecture delivered before the Franklin Institute, Philadelphia, 1887. *Franklin Institute Journal.*

[2] Mineral Physiology and Physiography. By T. Sterry Hunt. Boston, 1886.

[3] The Chemical Basis of Plant Forms. By Helen C. De S. Abbott.

[4] T. Sterry Hunt, page 18.

absorbing questions of the moment for investigation, but the evolution of compounds from these elements and their possible influence upon the external forms of plants is of equal interest.

That directive force which controls the different groupings of atoms in a molecule under the solid, liquid, or gaseous forms of matter, manifests itself in still more complicated conditions in each grade of the chemical compounds of living cells, and thus from the single cell to the highest of plants is ever active.

It is not my wish to claim for plant chemistry more than the facts at my disposal will allow; though in the past, and this should not be overlooked, without the aid of the imagination to penetrate the avenues of the unknown, many of our well-established scientific facts would still be buried from sight.

The chemical analysis of the dead plant and the study of the chemical changes occurring in the living plant are among our means for some of these investigations; and much of all the knowledge derived from each field of chemical research may be utilized in aiding to unravel the mystery of these changes in the vegetable cell.

In the mineral kingdom certain elements are invariably associated with others, as nickel with cobalt; and in plants we find not only two or more compounds invariably present together,—*i.e.*, tannin and starch in the tannin groups, lime and saponin in the pink family, Caryophyllaceæ,[1] resins and saponin in all of the saponin-containing groups, and sugar and silica in the grasses, Gramineæ,—but also in certain plant groups we notice the predominance of special compounds, and their absence in other groups. The grouping of these compounds in definite association must bear some relation to their respective sequence and formation, and cannot be the result of accident. That the cinchona plant does not manufacture the alkaloids of the poppy, but each its own particular series of compounds, illustrates this.

I have said, elsewhere,[2] "the chemical compounds of plants do not occur at random. Each stage of growth and development has its own particular chemistry. . . . The result of experiment shows that the presence of certain compounds is essential to the vigor and development of all plants, and particular

[1] Die Pflanzenstoffe, by Hilger and Husemann, p. 532; E. v. Wolff, J. pr. Chem., li. 24; lii. 86; Wolff, Aschenanalysen, 1881, 144, 145.

[2] The Chemical Basis of Plant Forms.

compounds to the development of certain plants." It may be inferred that "plant chemistry and morphology are related. Future investigation will demonstrate this relation."

The theory of evolution, which underlies all mineral and organic forms, comprises the evolution of the component parts of the whole, and, since the structural bases of minerals and plants are chemical compounds, their evolution must necessarily be included in a study of plant-life. Whether this life reveals itself in the perfume of sweet flowers, or in the manifold forms of vegetation, from the simple mass of plant-jelly to the majestic forest-tree, its dependence upon matter invokes the most eager desire to acquaint ourselves with its various manifestations.

When matter, through chemical change, exhibits properties of absorption, metabolism, excretion, reproduction, contractility, automatism, and irritability, it is said to be living. In this condition it is called protoplasm. This substance is very complex and of undetermined composition, though its proximate constitution is known.[1] It is always present where life, as defined, is found, apparently the same in the lower as in the higher plants.

The lowest forms of plants, plasmodia, are irregular-shaped masses of jelly, undifferentiated in form, function, and chemical composition. This living jelly is described "as a colloidal albuminoid united with more or less water."[2]

Plant-cells, when alive, are composed of a semi-fluid albuminous substance very like the plasmodia, closed on all sides, with a watery liquid holding salts and saccharine substances in solution, and lying in contact with a firm elastic membrane called the cell-wall; also, like it, closed on all sides, and consisting of cellulose, water, and inorganic matter. Some of the Algæ and all higher plants are congregations of these cells grouped as tissues and organs, and their albuminoid contents are undergoing continual change; in life it is a building-up process, the food being supplied from the gases, water, and inorganic substances of the surroundings, and elaborated in the plant's own laboratory to meet its needs.

The vegetable kingdom does not usually claim our attention for its intellectual attainments, although its members would cer-

[1] Reinke and Rodewald, Berlin, 1881; Physiological Botany, by G. L. Goodale, 1885, p. 197.

[2] T. Sterry Hunt, Min. Phys. and Physiography.

tainly seem to possess greater chemical skill than a higher race of beings exhibit in their laboratories. Some few of this higher race are "going to take lessons" how to construct proteids and carbo-hydrates as we are told our now automatic cousins were once taught to do; though man fails to consider that it may be a lost art, and the secret has died with the plants in a "catagenetic" decline.

All plants and their products are composed of two general classes of compounds,—volatile and fixed. The former, on incineration of the plant, is transformed into gases, leaving the last as so-called ash-constituents.

I will very briefly refer to the sources of the substances which go to the building of the plant structure. Green plants derive their carbon from the carbon dioxide of the atmosphere, and even from complex organic compounds, since Darwin[1] has shown that insectivorous plants, by means of their modified leaves, are able to absorb flies and other small insects.

Plants which do not contain chlorophyll, as fungi, take their carbon from complex compounds of decaying organic matter. Not only do all the so-called organic compounds of plants contain carbon, but it is found also in the form of carbonates.[2]

Hydrogen is absorbed by all plants in the form of water, or ammonia and its compounds, or in complex substances, as mentioned above. Oxygen is taken up by plants free or in combination in water or in salts, and there are six possible sources of nitrogen supply; but I will not delay by going into this subject.[3]

Sulphur and phosphorus are constituents of proteids, and are derived from inorganic compounds. In addition to these the elements essential to the nutrition and maintenance of the life of all plants are potassium, calcium, magnesium, iron in the case of green plants, its absence producing the condition of etiolation; and, in certain cases, chlorine. Silicon, fluorine, manganese, sodium, lithium, rubidium, cæsium, barium, strontium, aluminium, zinc, copper, arsenic, titanium, iodine, and bromine have also been found among the ash-ingredients of certain plants.

[1] Insectivorous Plants.

[2] Ann. Phys. et Chim., Berthelot.

[3] The Economical Aspect of Agr. Chem., by H. W. Wiley, Proc. A. A. A. S., vol. xxxv., 1886.

These ash-ingredients are usually present in each plant-cell, in the cell-wall, imbedded in the cellulose and partly in the contents of the cell. The salts of the alkaline metals, sulphates, chlorides of magnesium and calcium, also soluble silicic acid, as in *Equisetum hiemale*,[1] occur in solution in the cell-sap, and insoluble salts exist in the tissues of plants.

The differences in the composition of the ash of plants show that each plant is endowed with a specific absorbent capacity; thus a gramineous plant[2] is able to withdraw relatively larger quantities of silica from the soil than a leguminous plant. The latter can only do so to a very slight extent.

The absorbent capacities of allied species are very different. Again, individuals of the same species yield different ash-constituents, depending upon their vigor, and at different periods of growth the ash-composition varies. In a summary of experimental results it has been stated that[3] "similar kinds of plants, and especially the same parts of similar plants, exhibit a close general agreement in the composition of their ashes, while plants which are unlike in their botanical characters are also unlike in the proportions of their fixed ingredients."

Certain marked varieties of plants appear to be peculiar to and developed by certain soils, as the violet, *var. calaminaris*, and the penny cress, in zinc soils.[4] In the leaves of the latter plant thirteen per cent. of zinc oxide was found, and I have found manganese in the different portions of *Yucca angustifolia*[5] grown near Lake Valley, New Mexico.

Plants may absorb from the soil mineral matters independently of their use or harmfulness to the plant, but the absorption of essential inorganic constituents will depend upon their relation to the changes in the vegetable cell.

The ash-constituents of a plant increase from the roots upward to the leaves, the largest percentage being found in the younger portions of the growing plant, and I have observed this same principle on a more general scale running through the entire plant kingdom, for the largest ash-percentages are found among those plants lower in the evolutionary scale, which would

[1] Lange, Ber. d. deut. chem., Ges. xi. [2] Wolff, Aschenanalysen, 1871.
[3] How Crops Grow, by S. W. Johnson, London, p. 145.
[4] A. Braum and Risse, Sachs, Exp. Physiologie, 153.
[5] Amer. Phil. Soc. Trans., H. C. De S. Abbott.

correspond to the larger ash-percentage of younger, or formative, parts of the growing plants. Some of these lower groups, as the diatoms of the Algæ and the vascular cryptogams,[1] contain enormously large ash-percentages; in the Horse-Tail, *Equisetum*,[2] 60 per cent. alone of silicic acid. The *Lycopodium*,[3] in addition to 14 per cent. of silicic acid, contains 27 per cent. of alumina and 2.5 per cent. of manganese. Among comparatively lower plants the willow and poplar[4] are rich in ash-constituents; the former[5] contains 1.53 per cent. of manganese. Members of the sedge order and grasses contain large quantities of silica; the rice-hull, 98 per cent. Various species of apetalous plants on the same evolutionary plane with these groups also contain a large percentage of ash-constituents, as the *Salicornia*, *Salsola*, *Chenopodium*, and *Atriplex*, also the Sugar-Beet.

I have stated what chemical elements are essential for the life of the lower, as well as the higher, plants; also those which may occur in certain plants; and I have spoken of the two general classes of compounds of which plants are built as the volatile and ash constituents. The four elements carbon, hydrogen, oxygen, and nitrogen enter into the composition of the first class of compounds, and the grouping of these elements with each other and to the ash-elements constitute what is called plant chemistry.

As certain chemical elements are always present in plants, so certain changes occur and compounds are found generally, more especially among the albuminous constituents. However, even this statement should be restricted to saying that the first chemical reactions between these elements are probably identical at the start, the subsequent compounds formed depending upon the evolutionary stage.

The infinite variety of these compounds is only equalled by the numerous genera and species of the vegetable kingdom; though certain compounds frequently occur, as starch, sugar, tannin, and other bodies, correlated in special groups of plants with special and distinct properties. For example, the true

[1] Die Pflanzensenstoffe, p. 323, W. Lange; Bil. Ver., xi. 822.
[2] Ann. Chim. Phys., xi. 62, 208; Ann. Chim. Pharm., 77, 295.
[3] Flückiger, Pharmacognosie, Kamp; Ann. Chim. Pharm., 100, 300.
[4] Durocher and Lalaguti, Liebig's agric. Chemie, 8 Aufl., 371.
[5] E. Riechardt, Chem. pharm. Centralbl., 268, 567.

starch of the cryptogams will be found gelatinous in Algæ, replaced in Fungi as glycogen, and only in the lowest of the flowering plants does it occur in the simplest stratified form; from this stage to the highest of plants, the Compositæ, in which it occurs as a crystalline substance called inulin, it may be traced from plane to plane of plant-group development in a succession of stratification until it reaches its highest point in our most evolved plants. So strongly marked are these varieties of starch-forms that some investigators, notably Nägeli, have proposed this means for the identification of many plant families.

The many kinds of vegetable sugars known to chemists also have their locations, not only during different stages of the individual plant-growth and in different parts of the plant, as synanthrose,[1] the especial sugar of the unripe grain of rye and wheat, but also in certain families, some one kind of sugar will predominate in many of the individuals. The tannins of the oak, beech, and poplar are not those of the higher plants.

At a certain stage of plant evolution, glucosides, substances capable of splitting up and yielding, among other products, sugar, appear. I have observed in those plants where large percentages of such substances are found a diminished proportion of starch and sugar,[2] or their absence, notably in soap-bark and species of the *Yucca*.

The waxes, oils, camphors, resins, acids, and other classes of vegetable compounds might be similarly cited as offering characteristic properties in various plants in which they appear, but the examples given are ample to illustrate my point, that the chemical compounds of plants should be considered from three sides, viz.:

1. In their own development through many plant groups from a gelatinous or undifferentiated compound to a polymer, or a substance of the same chemical formula having a solid or crystalline form.

2. In their succession of changes which may be observed during the different stages of the individual plant's growth, and the relation of these chemical changes to other compounds present in the plant.

[1] Ripening of Seeds, by A. Muntz, Ann. Agronom., xii. 399, 400; Jour. Chem. Soc., Feb. 1887, p. 173.

[2] Trans. Amer. Phil. Soc., *Yucca angustifolia*.

3. The location as predominant of some one or associated compounds only in certain plants on similar evolutionary planes.

These three conditions correspond to what was stated at the beginning, that a law of universal progression may be traced wherever matter or force exists.

There is no absolutely certain knowledge of the precise character of the chemical changes which these plant compounds undergo, though we have some information about them. Investigations are being vigorously pushed in this department of plant-life, and it may be reasonably inferred that definite facts will be obtained on many of these subjects.

It would seem from the latest researches that the albuminous or proteid compounds to which life is essentially linked are formed from a compound containing nitrogen, called an amide, and some carbo-hydrate; its sulphur and phosphorus supply being derived from inorganic sources. This amide is probably asparagine or a related body. Various suggestions have been offered to explain its formation in the plant, from the breaking down of protoplasm to its construction from simple nitrogenous and carbon compounds, and among the latest investigations,[1] the results show that the formation of asparagine is independent of carbo-hydrates, and that the amide formed is not a by-product of the interchange of matter within the plant. The author of these experiments considers that asparagine is formed by the union of inorganic nitrogen compounds and malic acid within the plant, the acid being derived from the carbo-hydrates.

Other nitrogenous compounds, as the alkaloids, for example, are probably formed from the complex albuminoids, and in fungus plants which are especially rich in nitrogenous compounds alkaloids are common.

It has been generally held that alkaloids with resins and some other compounds occurring in plants are waste products, but this cannot be accepted as final. The researches[2] of Selmi, Gautier, Etard, Brieger, and others have broken down an imaginary distinction between plants and animals which is of interest in this connection. They show that the production of

[1] O. Müller, Landw. Versuch. Stat., 1886, 326–335; Jour. Chem. Soc., p. 70, Jan. 1887.

[2] Les Alcaloides d'origine Animale. Par Dr. L. Huhouneng, Paris; Chem. News, Dec. 10, 1886.

alkaloids is a general function common to all living cells, whether they be Bacteria or the cells of living animals.

In the animals with their excretory functions these poisonous substances would be readily eliminated from the system, but it seems to me that in the absence of homologous organs in plants these compounds might be used again for the building up of tissue and prevent the accumulation of products detrimental to plants, and the recent investigations of Kellner[1] on the composition of tea-leaves show that this view is not unlikely, for he states that the non-albuminoid nitrogen is almost wholly absent during the latter stages of growth, being found as theine; in the seeds the albumen has increased, but no theine is found, thus the author believes that positive proof is afforded that the alkaloids are a decomposition product of albumen, and capable of again forming albumen like asparagine and glutamine.

It will not be possible in this place to enter more fully into the details of the chemical changes going on within the plant. My time will not allow a discussion of the changes of starch into sugar, and conversely, nor a review of the many steps in the transformation of protoplasm into the simpler products of cellulose, chlorophyll, and other substances; and it may be well to say that the ideas of physiologists in regard to these changes are unstable, since the acquisition of new facts seems to unsettle former opinions. But, to illustrate the revolution within the last few years from former views held in plant chemistry, I will mention that sugar is not, in all plants, a reserve or plastic body, and in some few (for example, the sorghum-cane[2]) it must be regarded rather as a waste product, and its advent in larger percentage after the maturity of growth marks the decay of the plant and attends its euthanasia.

I have desired, by entering into all of the above particulars, to prepare for a consideration of the compounds which are formed by these chemical successions and occur through the plant kingdom. In treating of this subject I shall have so frequent occasion to speak of the different plant families that, for convenience, I shall use the order of evolution for flowering plants proposed by M. Édouard Heckel,[3] and which is represented in the table.

[1] Landw. Versuch. Stat., 1886, 370, 380; Jour. Chem. Soc., Jan. 1887, p. 73.

[2] On the Variations of Sucrose in Sorghum Saccharatum, by H. W. Wiley, Botanical Gazette, vol. xii., March, 1887.

[3] Revue Scientifique, 13 Mars, 1886.

SCHEME OF PLANT EVOLUTION.

By M. Édouard Heckel.

Processes.		*Apetalous.*	*Monocotyledons.*	*Dicotyledons.*	
				Cupuliflores.	*Thalamiflores.*
Simplicity of Floral Elements.	Amentales.	Casuarineæ, Myriceæ, Juglandeæ, Salicineæ, Carylaceæ, Cupuliferæ, Betulaceæ, Balsamifluæ, Plantaneæ.	Fluviales. Lemnaceæ, Naiadeæ, Potameæ.		
	Spadiciflores.	Piperaceæ, Ceratophyllaceæ, Chloranthaceæ, Saurureæ, Datisceæ, Nepentheæ.	Spadiceæ. Jugcagineæ, Aroideæ, Pandaneæ, Cyclantheæ, Palmea, Typhaceæ.		
Metamerization. Multiplicity of Floral Elements.	Monimo-Urtico Polygonales.	Monimiaceæ, Urticeæ, Cynocrambeæ, Canabineæ, Ulmaceæ, Celtideæ, Moreæ, Polygoneæ, Amarantaceæ, Boselleæ, Chenopodeæ, Artocarpeæ.	Glumoideæ. Cyperaceæ, Gramineæ, Restiaceæ, Eriocaulaceæ, Xylideæ, Junceæ, Commelyneæ.	Rosales, Ficoids.	Polycarpels, Hydropeltideæ.
	Daphnales.	Phytolacceæ, Laurineæ, Myristicaceæ, Santalaceæ, Loranthaceæ, Cytineæ, Balanophoraceæ, Begoniaceæ, Elæagneæ, Proteaceæ, Thymeleæ, Nyctagineæ.	Liroideæ. Liliaceæ, Irideæ, Alismaceæ, Butomeæ, Hydrocharideæ, Pontederaceæ, Taccaceæ, Bromeleæ, Tillandsiæ, Musaceæ, Zingiberaceæ, Cannaceæ.	Saxifrages.	Cruciformes-Euphorbiales, Parietales, Tilio-Malvales, Gamopetelous-Isogynes.
				Leguminous plants, Rhamnals, Bicarpels.	Gamopetalous-Anisogynes, Labiatiflores.
Cephalization. Simplification of Floral Elements.	Serpentaires.	Asarineæ, Aristolochiaceæ.	Gyandres. Apostasiaceæ, Orchideæ.		
				Apocyneæ, Asclepiadeæ.	
	Epicorolliflores.			1. Corysanthérie.	Caprifoliaceæ, Campanulaceæ, Lobeliaceæ, Valerianeæ, Dipsaceæ.
				2. Synanthérie.	Goodeniaceæ, Brunoniaceæ, Stylideæ, Compositæ.

The author classes all these plants under three main parallel divisions, from the lowest of the apetalous,[1] mono- and dicotyledonous groups to their respective highest plants. These three main columns are divided at the same point into three general planes. On plane 1 are all plants of simplicity of floral elements or parts; for example, the black walnut with the simple flower contained in a catkin. On plane 2 are plants of multiplicity of floral elements, as the many petals and stamens of the rose; and, finally, the higher plants, as the orchids among the monocotyledons, and the Compositæ among the dicotyledonous plants, come upon the third plane, or the division of condensation of floral parts.

These three characteristics, simplicity, multiplicity, and condensation of floral elements, are correspondingly repeated in each of the three horizontal planes, and even in individual orders in their lowest and highest plants.[2] To facilitate the comprehension of this classification I have assembled a sufficient number of the plants themselves, so arranged as to place before you a living representation of this complicated diagram.

(To be concluded.)

HORNLESS RUMINANTS.

BY R. C. AULD.

THE group of mammals known as Ruminants exhibits certain characters more or less dependent and highly typical. Among these is the possession of horns. The Ruminants are the only recent mammals provided with bony extensions of the

[1] Heckel's division of apetalous plants from mono- and dicotyledonous groups has been criticised by some botanists as an artificial method of classification. Since all botanical classifications have been declared, on botanical authority, in a measure, artificial, the author does not feel called upon to apologize for introducing M. Heckel. She has found his scheme to answer her purposes, provisionally, more fully than other classifications, and she is indebted to him for a means of presenting her subject, which would be otherwise impracticable. Further than this she is not responsible for advocating the classification. M. Heckel's table is published with his paper, "Les plantes et la théorie de l'evolution," in the *Revue Scientifique*, 13 Mars, 1886.

[2] Plate XXV. illustrates this principle for the three horizontal planes, which is also applicable to the orders.

PLATE XXV.

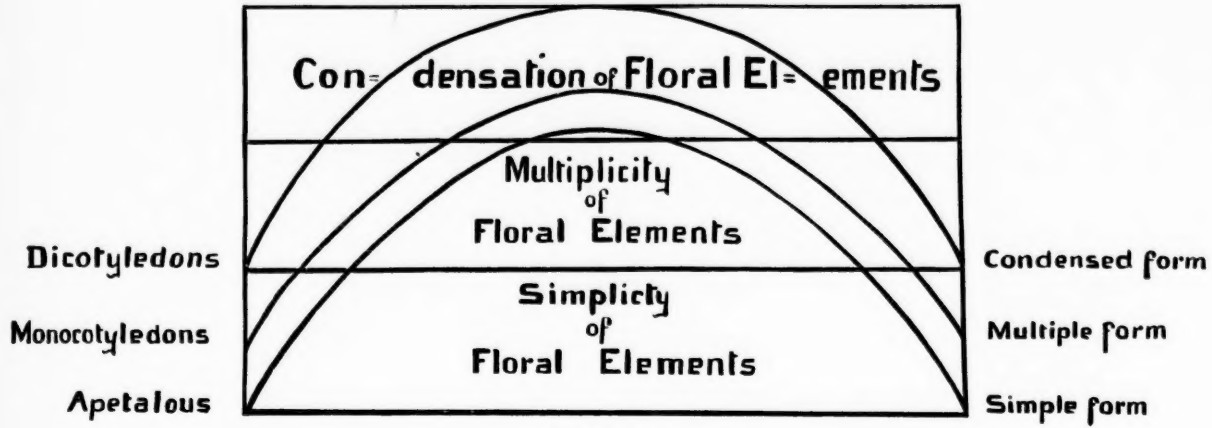


PLATE 1.

frontal bones, to which may be attached, or round which may be sheathed, horny appendages or coverings. But all of the group do not possess these; camels, etc., and two tribes of deer are normally hornless. And among the others, as it is our object to show, the horns are by no means constant, or even necessary. In reference to their horns, Ruminants may be thus arranged:

a. Camels (including Llamas, etc.) . . . Without horns.
b. Giraffes, horns persistent.
c. Deer (including the hornless deer), horns deciduous. } Solid horns.
d. Antelope, Goats, Sheep, Oxen, horns persistent[1] . . . . . Sheathed horns.

In reference to the particular character that is to engage attention, the group may be divided in two divisions:

I. Normal hornless Ruminants.
II. Special hornless Ruminants.

I. Normal Hornless Ruminants.

Camels, llamas, alpacas, guanacos, chevrotains, water, and musk-deer are the normal hornless Ruminants, in both sexes. All these have, however, efficient canine teeth.

II. Special Hornless Ruminants.

Under this division come all those instances, among others than those just named, which it has been the object to investigate.

Giraffes.—Though the giraffe seems normally to be horned in both sexes, a description of the horns is necessary. The head is adorned with three prolongations of the bone, two of which, in the usual place of horns, are generally described as such. They are covered with a velvety skin similar to those of the deciduous-horned deer at their first growth, but which does not fall off; and at the tip they are surmounted by strong bristly hairs. In the adult the internal structure is hard and solid, but in the young there has been observed an appearance of a cellular centre, nourished by vessels. The third protuberance is in the centre of the skull, and appears as a rounded knob, and is of a very spongy texture (*Jardine*). Both sexes are born with the horn of a certain distinct development; they are persistent

[1] I know of exceptions to this.

throughout life. I have not discovered any instances of the absence of these peculiar horns. But their structure in their earlier stages seems somewhat similar to some developments in hornless deer, etc.

Deer.—In deer the horns are solid. They have a peculiar manner of growth familiar to most. After the third year, when their horns are named "antlers," they are annually shed and annually reproduced in a more and more complex manner till they attain their limit of "royalty" and maturity. This process, as will soon appear, it is of the utmost interest to notice. It may be termed the individual-life development, and this it will be of importance to compare with the species-life development. With a single exception of the Arctic reindeer, all female deer are normally hornless. The exception in this case must prove of advantage to the female of this species. It may enable her, by the shovel-like processes that overhang the brow, to procure access to food in her snow-bound home. Abortive or rudimentary horns occasionally appear in female deer. The male also is *frequently* without them.

Lord Walsingham and Sir Ralph Payne-Gallway, Bart., in their book on "Shooting" (Badminton Library) give some interesting notes on Deer by Lord Lovat, who says, "Sometimes stags have no horns. These are called humle stags. If naturally so, and otherwise perfect, they will thrash any other stags of their own, or even considerably greater weight. We have known several of them undisputed masters of large herds."

The late Mr. Horatio Ross, the famous sportsman of Ben Wyvis, Inverness-shire, Scotland, shot a hornless stag in the autumn of 1880. Mr. Ross then wrote: "When I tell you that I never before saw a similar stag dead, you see that it must be a rare specimen. It is a 'hummelled'[1] stag. I have frequently in this great forest seen hummelled stags,—that is, full-grown stags without horns. I once shot a stag of that description at Invermark. The stag killed the other day is a splendid animal, weighing 16 stones, perfectly clean."

In a note in the "Naturalist" department of *The Field* (London) I made reference to one of the hornless stags of Ben Wyvis, and to that note Mr. Edward Ross, son of the gentleman just mentioned, writes thus, March 1, from The Rounds, Wimbledon:

[1] Scotch for hornless.

"Allow me to say that hornless or 'hummel' stags, as they are termed in the Highlands, although seldom shot, are not quite so rare as is often supposed. When a herd of stags is found the telescopes of the sportsmen are usually directed towards those with the finest horns, and thus the 'hummels' are apt to escape notice in the crowd; but whenever a herd of several hundred stags is collected together, it will be found, oftener than not, if carefully examined with the glass, to contain one or more 'hummels.' The stag whose head your correspondent refers to was shot by me six years ago in Ben Wyvis Forest, Ross-shire, where it had been known for several years. At the time I shot it it was in company with about three hundred and fifty other stags, among which I observed two other 'hummels' younger than the one which I killed.

"In point of size and condition, these stags are in no respect inferior to their horned brethren. The stag referred to weighed over sixteen stones, and I recollect seeing another, shot by the Duke of Westminster in the Reay Forest, Sutherlandshire, which also exceeded sixteen stones weight, both of these being weighed 'clean,'—that is, without heart, liver, or entrails.

"Strange as it may seem, a full-grown 'hummel' is sometimes very formidable in fight. I have seen one during the rutting season in possession of a large herd of hinds, who succeeded in driving off all his horned rivals.

"Although devoid of horns, the heads of those which I have seen have had slight excrescences, concealed by hair and covered with skin, at the top of the head where the horns ought to have grown. I have never examined the bare skull of one of these deer, but the excrescences which I have noticed have not had either the size or the shape of the stump of bone attached to the skull from which horns grow, and have had no appearance of ever having borne horns. I have never doubted, nor heard it questioned by others experienced in Highland deer-forests, that these stags are hornless from their birth.

"'Haviers,' as stags which have been altered when calves are termed, have no horns, as is well known, and in the early part of the season these, seen through the glass, might be mistaken for 'hummels'; but as the season advances the necks of the latter swell, and (except in the matter of horns) they assume all the characteristics, both in appearance and behavior, of ordinary stags, and are thus easily distinguished from 'haviers.'"

H. von Nathusius, Altaldensleben, province of Saxony, supplies the following interesting notes:

"Hornless stags are of no rare occurrence in some parts of Germany. I know of their occurrence in a wild state in the Harz Mountains and in the royal deer-forests of the Görde in

the province of Hanover, and Letzlingen in this neighborhood (province of Saxony). They are called by the people 'büffel,' 'flattköpfe' (flatheads), 'hermits,' and perhaps by other popular names. The last name is derived from the former opinion that they are not fertile, although it is beyond doubt that they are so, and produce a large percentage of hornless progeny. They are killed wherever they are met with in well-preserved forests, and therefore are now scarce. The cause of this defect is attributable to insufficient food and close inbreeding. The Görde and Letzlingen are fenced with timber, mostly fire-wood. So far as I know them from my own experience, these hornless deer are very massive, but not high on the leg, and, as they are much persecuted, they are seldom full grown. I shot one at a royal battue in the forest of Letzlingen on November 13, 1874. He was rising three years, judging by the teeth, but badly developed and very poor in venison; he had evidently been rutting, and, from the big neck and mane, could not be mistaken for a hind, though there was but a very small protuberance on the head. I preserved the skull. The 'Hornzapfen'—*i.e.*, the bony excrescence on which the horns had to grow—in this case slightly

FIG. 1.—Head of Hornless Stag.

pierced the skin, but were covered by hair. This varies, however, in hornless stags. I have another skull where the 'Hornzapfen' were entirely covered by the skin; and it is no rare occurrence to find an undeveloped formation of horn on the bone, but only the base or Rosenstock, as it is technically termed, with a flat top reaching through the skin, but covered almost with hair. Such skulls from the Harz are in the possession of Baron Gussert and Herr von Asseburg. The man who perhaps knows most about hornless stags is the Königlicher Förster Pookh, Forsthaus Röthen, Görde, province of Hanover.

"In the *Illustrirte Zeitung*, published in Leipzig, October 2, 1886, there is a head of a hornless stag (Fig. 1) and a fight between a horned and a hornless stag, drawn from life by Beckmann, an artist who often contributes sporting sketches to the English illustrated papers. This picture confirms the opinion that hornless stags hold their own against antlered ones. It is perhaps of interest that at Letzlingen, where some thousand fallow deer are kept, together with some hundred red deer, hornless bucks never occur among the former."

One of these skulls is now in the Museum of the University of Cambridge.

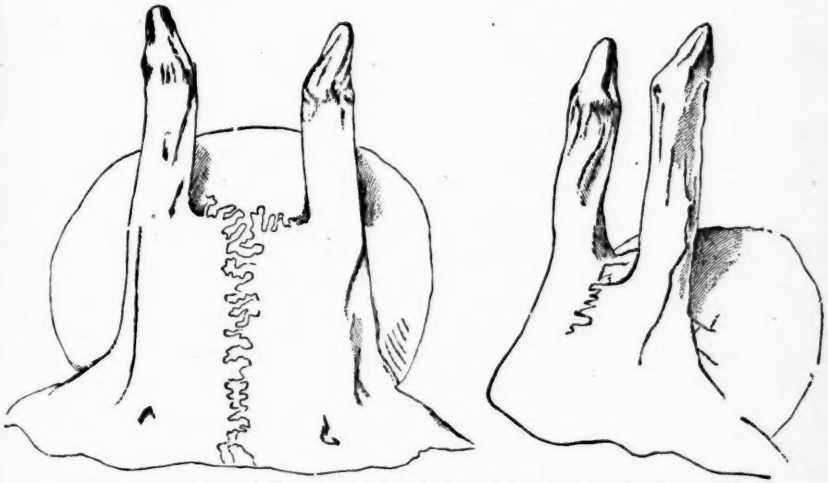


FIG. 2.—Skull of adult Hornless Roebuck (life-size) shot, July 7, at the halduishle, province of Saxony, Prussia.

"Since the above was written," Herr von Nathusius writes me, "I have got notice of a hornless roebuck (*Cervus capreolus*) that had been shot some years ago in this neighborhood. I enclose a sketch" (Fig. 2). The following notes are from Ludwig Beckman:

"Having long been familiar with hornless stags as annual visitors to the Göhrde Forest, perhaps the following notes on the subject may be of interest:

"In the German sporting literature both hornless and single-horned stags are mentioned since the seventeenth century. The former were regarded as unfertile, and called 'monks'; the latter were known as 'murderers,' because they were suspected to be

dangerous to the normally horned stags in fighting. In none of the deer-forests were they found in any number, but appeared here and there singly, seldom leaving any progeny, as they were generally soon destroyed. In Behlen's *Forst und Jagdzeitung* for the year 1831 there is the following notice: 'Remarkable stags in Göhrde.—There have been observed of late years stags with only one horn. The keepers and foresters assert that these single horns are shed annually, and that the animals show no signs of infirmity.' In the same year (1831) a hornless stag was killed in another forest (Evensen) near Hanover, which had evidently been rutting hard. In July, 1832, a hornless stag, weighing nearly two hundred kilogrammes, was killed in the shootings of Graf Bernstorf, Gartow. This stag was first observed in the rutting season 1829, with a herd of fifteen to eighteen hinds, chasing the horned stags by striking at them with the fore-legs. In 1850 I found skulls of single-horned stags in several collections at Hanover, and heard from the royal foresters that there were more in Göhrde, and that this variety would be preserved. Subsequently the destruction of the hornless stags at Göhrde was often contemplated, but, to my knowledge, was never earnestly carried out, for it was evident that the experiment would not be of much use. Hornless stags are often regarded as a peculiar variety, but then so are stags with only one horn,—in fact, there are so many individual variations of this kind, that it is impossible to draw a line between stags with and without horns in places where hornless stags have long existed.

"In the Göhrde Forest, where neither 'flat-heads,' or hornless stags, nor single-horned stags, are rare, I found, in 1883, among the forty-five stags killed at the royal battue, perhaps five or six warrantable stags, with fully-developed horns; twenty-five middle-sized and small, but with rather regularly-shaped horns; one old stag with only one fully-developed antler on one side and a short boss[1] on the other side; some heads with an antler only half developed, and one boss projecting, more or less, through the skin of the forehead. Then followed two perfect hornless heads, with bosses, but, of course, covered entirely with skin. Among other deer killed that day were several young stags with thin, slender horns of a white color, resembling bleached horse-ribs ('switch-horns'), while others were bent and twisted like corkscrews. The difference between the undeveloped bosses of a hornless stag, like Fig. 3, and that of a warrantable stag, with well-developed horns, may easily be seen by comparing Fig. 3 with Fig. 4, the latter having been sketched after the annual shedding of the horns. Some hornless stags have only small, flat rudiments of bosses, which are not visible until the skull is stripped of its skin.

[1] In German, Hornzapfen or Rosenstad.

"The bosses of a flat-head, or hornless stag, never produce or bear horns. These flat-heads, as well as the single-horned stags, are nevertheless fertile, their necks swelling, as usual, towards the rutting season, when they are roaring and fighting with the horned stags. They attack a rival by raising themselves on their hind-legs and striking at them with the fore-legs. Generally the horned stag adopts the same mode of fighting, without using his more dangerous weapons, the horns, as I have often observed.

FIG. 3.—Skull of Hornless Stag.

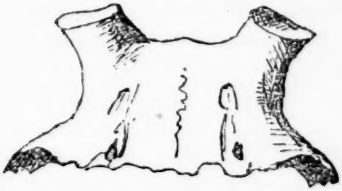


FIG. 4.—Skull of a Horned Stag, after shedding the horns.

But I have been told by foresters and keepers that they have sometimes seen hornless stags fighting with antlered rivals forehead to forehead; and Oberförster Wallmann, in Göhrde, once saw a hornless stag in this way pressing and driving away a horned rival from a lot of hinds. I can only explain this by the fact that hornless stags are often superior in bulk and weight to horned ones. The loss of horns in male deer is certainly not the result of long inbreeding. In the Göhrde Forest, where from five hundred to six hundred deer roam over an area of five thousand hectares, and where the fences have openings (einsprünge), so that the wild deer may enter at any time, no such inbreeding takes place. It is well known in that district that in former times wild stags came during the rutting season even from Mecklenburg, across the Elbe. In the royal forest near Springe, in Hanover, which is surrounded by high walls, and where the deer have been breeding in and in for forty years, the stags have nevertheless well-developed horns, and Oberförster Hesse, of Springe, told me that not a single hornless stag had been observed during all that time."

The musk-deer, smaller than the roebuck, differ from the general character of deer in having no horns in either sex. "To compensate the want of horns" the males have two long and slender canine teeth, which project from the jaw like elephants' tusks, only that they curve inwards. In this tribe the canines, instead of being arrested in their embryo stage, as in the other common Ruminants, gain full development. The musk-deer (*Moschus moschiferus*) are natives of Thibet and Nepaul.

The water-deer (*Hydropotes inermis*) is a singular deer without horns, and with large projecting canine teeth. It is found in China in the low meadows and scrubs bordering the rivers, and is remarkable for its excessive fertility, the female being said to produce six or seven young at a birth.

"In the large riverine islands of the Yangtsze, above Chinkiang," Mr. Swinhoe tells us, "these animals occur in large numbers, living among the tall rushes that are there grown for thatching and other purposes. The rushes are cut down in the spring; and the deer then swim away to the main shore and retire to the cover of the hills.

"In autumn, after the floods, when the rushes are again grown, they return with their young, and stay the winter through. They are said to feed on the rush-sprouts and coarse grasses, and they doubtless often finish off with a dessert from the sweet-potatoes, cabbages, etc., which the villagers cultivate on the islands during winter.

"Fortunately for the deer, the Chinese have an extraordinary dislike for their flesh. They are therefore only killed for the European markets, and sold at a low price. The venison is coarse and without much taste, but is considered tolerable for want of better; it is the only venison procurable in Shanghai."

Specimens of the latter are to be seen in the Zoological Society's Garden, London.

Passing from living to extinct forms of deer, there has to be noted the discovery of polled or hornless skulls of the extinct Irish elk. But some much more remarkable discoveries have been made in the history of the species-life or development. It is found that the horn-development, in complexity, is exactly parallel to that seen in the development of horns in the individual of to-day. Professor Boyd-Dawkins[1] states that in the lower meiocene "no member of the family is possessed of antlers." They are hornless,—polled. In the mid-meiocene strata Professor Gaudry notes small branching erect antlers persistent throughout life, and characterized by the absence of a burr. This is considered by Professor Leidy as a form intermediate between the antlers of deer and the horns of the antelope. It may fairly claim to be the most rudimentary form of antler belonging to a type no longer represented. The true starting-point of the antlered deer of the post-meiocene age is presented by the simple forked crown of the *C. dicrocerus* of the mid-meio-

[1] Early Man in Britain.

cene. The cervine antler of the upper meiocene becomes more complex, but is still small and erect, like that of the roe. In the pleiocene it becomes longer and longer, and altogether more complex and differentiated, some forms, such as the *C. dicranios*, being the most complicated known either in the living or fossil state. These successive changes are analogous to those which are to be observed in the development of the living deer,—which begins with a single point, and increases the number of tines till the limit is reached. It is obvious from the progressive diminution in size, and complexity of the antlers in tracing them back from the pleiocene into the mid-meiocene of Europe, that in the latter period we are approaching the zero of antler development. In the lower meiocene Professor Boyd-Dawkins has failed to meet with evidence that the deer possessed any antlers.

Thus in deer the polled head was the condition of the family during its embryo age of development, as it is in the living individual to-day. This was during the upper eocene period, "when generalized or ancestral forms of deer and antelope" were universally of the hornless type, whose associates were, also, tuskless Suidæ and hornless Rhinoceri.

Antelopes.—The indications, as just pointed out, of the earliest forms of antelopes are that in such stage they were unpossessed of horns. Darwin notes that, "with the antelopes a graduated series can be formed, beginning with the species the females of which are completely destitute of horns, passing to those having small rudimentary to those which have fairly well-developed horns, to those in which they are of equal size in both sexes."

A form between the deciduous solid-horned and the non-deciduous hollow-horned has been pointed out by Professor Gaudry.

The position from which the horns spring is a chief point to note in antelopes, as also that the bony nuclei of the horns are hard and solid, while in the other Ruminants to be noticed they are cellular and communicate with the frontal sinuses.

It would be interesting to make an anatomical comparison between the horns of the giraffes, the rosenstock of hornless deer, the horn-stock of antelopes, and the subcutaneous osseous rudiment sometimes felt in hornless cattle, but space does not permit

Goats.—Goats, which have been domesticated from the earliest times, occur hornless in both sexes. Jardine's description is, "Horns common to both sexes; rarely wanting in the female; in domesticated races occasionally absent in both." Describing several species of "common goat," he says, "As among the sheep, we have also a breed, white, and without horns, and here the distinction of the two forms is very close indeed, and scarcely to be distinguished, except by the hairy fleece and indication of a beard." He also describes and figures "two more grotesque-looking goats, which have been generally placed as varieties of the domestic breeds, and are represented on the next plate, taken also from the figures of Fred. Cuvier. They are the Nepaul goat and the goat of Upper Egypt. These two animals would almost seem not to be varieties, but distinct species, though, perhaps, there is not so much difference as we see in some of the races of dogs; and this is one of those points in natural history which is extremely difficult to prove, even with the most extensive menageries and most favorable situations. The most marked character in the black figure, the Nepaul goat, is its high and slender figure. The arched form of the nose, occasioned by the convexity of the nasal bones; and the long and pendulous ears, generally of a white color, or paler than the tint of the body. The other figure on the plate, the goat of Upper Egypt, is generally of a brown color, standing high, and somewhat of the form of the Nepaul goat. The hair longer and more shaggy, the bones of the nose very much raised, and the appearance of the chin and face, with the exhibition of the teeth, putting one in mind of the pugs among dogs. The ears are also ample and pendent; from the neck there is frequently hanging two fleshy tubercles, an accessory which is also sometimes seen in some breeds of sheep. In the female, the udder is always very pendent, sometimes almost touching the ground." The figures in the plate are *both* hornless.

Professor Low[1] says of the domestic goats, "Sometimes the horns disappear in one or both sexes; and in certain cases they become polycerate." Extending over the varied surface of Hindostan, the goats assume a prodigious diversity of color, aspect, and form. Sometimes they have horns, and sometimes they are destitute of horns. The Syrian goat, though so called, is not

[1] Domesticated Animals of Britain.

confined to Syria, but extended, by the countries of the Euphrates, into Arabia, and, with some slight change of characters, into Upper Egypt and Nubia. This kind of goat was known to the ancients, who mention it by the name of the Syrian, and sometimes by the Damascus goat. It is generally without horns. In Nepaul a beautiful goat is domesticated, which so much resembles the Syrian that both appear to be derived from a common stock.

Figuier states that of the common goat (*C. hircus*) "there is a subvariety without horns," and that the Syrian goat, pendulous-eared, is more frequently without horns than the common goat.

The writer of the article on Goats in the "Encyclopædia Britannica" (ninth edition), noticing the Maltese hornless variety, remarks, "but the absence of these appendages is likely a freak of nature and not the peculiar character of a particular species."

Mr. Henry Stephen Holmes Pegler, Secretary of the British Goat Society, in his well-known work, "The Book of the Goat" (1885), says,—

"A French writer, on the authority of an 'Encyclopædia of Natural History,' classifies the varieties into four distinct groups: 1. Goats with short prick ears, as the common goat, the hornless goat, and the dwarf goat of Guinea. 2. Goats with long, wide, pendulous ears, as the Syrian and Nubian, or Egyptian. 3. Goats with drooping ears and curly woolly coat, represented by the Angora. 4. Those having semi-pendulous ears and a downy undergrowth of wool, as the Cashmere. . . . As regards hornless goats, which this author places among the prick-eared varieties, it is a question whether there exists a breed without horns which may be relied on to reproduce that peculiarity without deviation. I am inclined to share the opinion of Professor Simonds, late Principal of the Royal Veterinary College, that there is no hornless race, but that the absence of the corneous appendages is purely a freak of nature apparent in all breeds, though doubtless in some more than in others, according to the fancy of a people for encouraging and perpetuating the peculiarity. At the same time, there can be no doubt but that by a careful selection, and breeding always from polled goats, a strain could be established which would produce, with tolerable certainty, hornless stock. The French writer referred to says, 'The goat without horns appears to have a rather ancient origin, for the modifications which characterize it are deeply rooted. We know in other respects but little concerning this pretty creature, whose most esteemed quality consists in the value of its flesh, which possesses but little odor, and is very good eating,

being often mistaken for mutton.' He then concludes by saying, 'The hornless goat is of Spanish origin.' Now the country where hornless goats are most common is Malta, and the close proximity of that island to Spain would lead to the inference that the Maltese is the kind here alluded to, especially as it is not mentioned elsewhere in the work. If this be so, however, the grouping is certainly at fault, seeing that the Maltese goat has decidedly pendulous ears, and cannot, therefore, be placed in the same category as the prick-eared varieties." (Pp. 18–21.)

He, on pp. 27, 28, describes "The Maltese goat" thus:

"If a really hornless breed of goats exists, it is the Maltese, there being more polled specimens among this variety, I believe, than any other. The greater proportion, indeed, are of the hornless type, and white or grayish-white in color, with brown or black spots. It is long-haired, of rather large size, with a long neck and head, the facial line being nearly straight. The ears are of considerable length and width, and as pendulous as those of a double-lopped rabbit. All the goats of this breed that I have kept myself, or seen, were thin, bony creatures, with very flat sides."

But all are unanimous in placing this variety foremost among milkers,—an important point to note.

On pp. 101–3, under the heading "Importance of Pedigree," he gives an analysis of a pedigree which he says he selected "as showing how, whilst most of the ancestors are hornless, a horned goat is produced."

In a paper by the same author in *The Live-Stock Journal Almanac* (1887), in referring again to the importance of the Record he says,—

"A perusal of this volume clearly demonstrates also what I have often stated, that the hornless, short-haired goats are far the most popular, and pay the best to breed. . . . Of course, I am aware, and admit, that there are also many equally good animals among horned goats. But hornless stock are unquestionably more in demand. Long-haired goats, on the contrary, with their correspondingly long and dangerous horns, are never popular, and very few indeed are now seen, as they are not taking in appearance."

The British Dairymen's Association, at their annual exhibition in London, has four classes for the reception of hornless varieties of goats.

Varo and Columella inform us that in their times the Romans

dishorned (as is now such a common practice in the Western States of America, among cattle) their goats and sheep of certain kinds. This would indicate that they were acquainted with the useful properties of hornless races of these Ruminants, which we, indeed, know to be the fact with the latter.

Sheep.—Generally considered sheep are described as having "horns common to both sexes, sometimes wanting in the females." The domestic breeds are, however, mostly polled.

Aristotle (4, xxvii.) states that in Libya the horned rams are born at once with horns, and not the males only, as Homer says, but all the rest also. In part of Scythia, near the Pontus, the contrary is the case, for they are born without horns.

Jardine figures a peculiar breed of Persian sheep. It is polled, with black head, ears, and neck, the rest of the body white: has pendulous ears and arched profile, stands somewhat high, and has short, crisp wool. It seems to resemble the breed of African and Ethiopian sheep. It also appears to spread itself into many varieties,—the Morocco breed, the Congo breed (covered with very loose wool instead of hair, with two wattles beneath the throat), the Guinea breed, and the Angora races (which have finer wool).

He also mentions the hornless Mysore as the most beautiful Indian breed. In Russian Tartary are polled, lop-eared, Roman-nosed sheep.

Prof. Youatt says ("Sheep"),—

"The primitive breed was certainly *horned*,[1] and those horns were of considerable size. . . . The polled sheep were probably an accidental variety, and when first occurring, cultivated partly for their singularity, and more for their utility, whether with reference to the additional closeness or folding of which they were capable, or the fewer accidents that were likely to occur, or, most of all, from the supposed docility and quietness of those to whom nature had not given these weapons of offence, and of the use of which all animals soon become too conscious. There is not, however, a polled breed of the present day in which lambs are not occasionally dropped with the rudiments of horns; some of these horns grow to their full size, and others are curiously attached to the skin alone, and either hang loosely down or drop off."

The first two figures he gives are (1) that which is common in the north and south of Asia, prevailing more than any other in

[1] Page 363 he says "*probably*" instead of "*certainly*."

Palestine, interior and north of Russia, and of which the Turcoman Kalmuck flocks, etc., principally are composed. It is fat-rumped and horned. The second cut (2), representing a ram of the Primitive Sheep, is that of the "fat-rumped polled sheep, prevailing in Persia." It is the same as mentioned by Jardine. Youatt discusses whether this breed,—the fat-rumped,—which mostly prevails in Palestine, is the same with that of which the sacred historians speak? He shows that the patriarchal breed was the sheep whose fat was principally deposited, not in the tail, but on the rump, or in those parts immediately connected therewith. The Persian polled sheep was the more beautiful specimen of the primitive fat-rumped breed.

"The level back and belly," says Youatt, "the rounded carcass, and the light small leg would induce the easy belief that from such animal our own down and mountain sheep might have originally sprung." This is a view similar to the opinion as to the Zebu being the ancestor of our domestic races of cattle.

In describing the Egyptian, Ethiopian, and Abyssinian fat-tailed sheep, he says in Nether Ethiopia the fat-rumped variety begins again to be found of rather smaller size than the Persian. The smaller sheep, resembling, and, except in size, identical with the Persian or primitive breed, is more prevalent. The cut given on p. 23 (the polled fat-rumped Persian) represents the usual Abyssinian, but of a somewhat larger size.

Many of the sheep of East India, and particularly the Mysore, closely resemble the Persian. They are without horns.

Professor Low says the polled Persian is found in Arabia, the countries of Euphrates, into Persia, whence it has been sometimes erroneously termed the Persian breed, though in no degree proper to Persia. They are found in Madagascar and along the southeastern coast of Africa, Abyssinia, and the countries of the Red Sea.

Youatt, in a note, mentions "a broad-tailed polled black ram at present in the Zoological Gardens, Regent's Park, that has floored most of his keepers, and is master over every sheep and beast in the place." This is of interest.

Columella has recorded his preference for the "hornless breed" of sheep.

Early English writers record their preference for the polled

varieties of sheep,—Markham, Sir Anthony Fitzherbert, Barnaby Googe, and W. Ellis.

Pennant divides sheep into two classes: (1) Ovis anglica—the Hornless, and (2) Ovis polyceras—the Many-Horned.

Gilbert White, writing from Ringmer, near Lewes, December 9, 1773, to Thomas Pennant, has the following on hornless sheep:

"One thing is very remarkable as to the sheep; from the westward till you get to the river Adur all the flocks have horns, and smooth white faces, and white legs, and a hornless sheep is rarely to be seen; but as soon as you pass that river eastward, and mount Beeding Hill, all the flocks at once become hornless, or, as they call them, poll-sheep; and have, moreover, black faces with a white tuft of wool on their foreheads, and speckled and spotted legs, so that you would think that the flocks of Laban were pasturing on one side of the stream, and the variegated breed of his son-in-law Jacob were cantoned along on the other. And this diversity holds good respectively on each side from the valley of Bramber and Beeding to the eastward, and westward all the length of the downs. If you talk with the shepherds on this subject, they tell you that the case has been from time immemorial, and smile at your simplicity if you ask them whether the situation of these two different breeds might not be reversed. However, an intelligent friend of mine near Chichester is determined to try the experiment; and has this autumn, at the hazard of being laughed at, introduced a parcel of black-faced hornless rams among his horned western ewes. The black-faced poll-sheep have the shortest legs and the finest wool."

John Lawrence, in 1805, gives a concise "Description of British Sheep," of which he enumerates eighteen polled races and some foreign races, as Dutch and Danish, which seemed to be varieties of the Spanish (Merino). Mr. Arthur Young, the celebrated author of "The Annals of Agriculture," wrote that "while in Spain I examined the sheep attentively. They are in general polled, but some had horns," etc.

Professor Boyd-Dawkins states, "The hornless breeds of sheep date back in our country from the days of the Romans, since the hornless skulls have been found associated with Roman remains in London." And "from the analogy of cattle it is certain that they were derived from a horned race, such as the Welsh or old Irish or Exmoor breeds. Nevertheless the horned is more abundant in the Roman refuse-heaps than the hornless, and in those days was the dominant breed."

H. von Nathusius writes me from Saxony:

"In Germany there are some polled sheep, particularly of the large, short-tailed, marsh breeds, that now mostly have been crossed with the long-woolled English. There are few of the aboriginal ovine tribes left untouched by Merino blood. Among the Merinos there is no regularity at all concerning horns. There are breeds in which almost all the ewes have small horns, and others, particularly in France, where even the rams are devoid of them. They have given them premiums, indeed, limited to hornless rams only. I some time ago bred a small flock of a cross between hornless French Mauchamp Merino[1] rams and Lincoln sheep from Lady Pigot's flock, and, strangely enough, a large percentage of the rams and an occasional ewe came with horns.

"In the collection of the University of Halle there is a very interesting suite of ovine skulls, beginning with such of the most strongly-developed horns, and consequently 'Hornzapfen,' down to the hornless tribes, where there are not any rudiments of the bony excrescence left, and finishing with skulls of the Italian Bergomask sheep, the largest breed in Europe, in which both sexes are always hornless, and in which you sometimes find in the place where the 'Hornzapfen' appear in horned sheep, a *depression in the bone.*"

In 1863 the French government introduced some of the famous *Ong ti*, or Chinese prolific sheep. The consignment was divided into three lots, one of which was sent to the Jardin d'Acclimation, where they have increased enormously. They weigh—well, as high as one hundred and fifty-four pounds; the flesh is of good quality. The wool is of mother-of-pearl brilliancy, but of common quality. The head, which is very small, is covered with short, close, and shining hair. The animal has no horns, but what gives the greatest peculiarity to the sheep is, that they have no ears. The legs are long and hairless; the body short; the chest expansive, and loin good; the tail is short and folds on itself in a crease of the skin that encloses a fat of very fine quality. The distinguishing trait of the race is its fecundity, producing from two to five twice a year. Two only are generally raised, though the mothers are excellent milkers.

[1] The male (hornless) of this breed is figured by L. Figuier.

(To be continued.)

EDITORS' TABLE.

EDITORS: E. D. COPE AND J. S. KINGSLEY.

In most university work study and instruction naturally cease with the beginning of the long summer vacation. The broiling suns of July and August are not conducive to the study of Greek roots, or problems connected with the fourth dimension of space. With biological studies the summer is most important, for then is the time when the student, relieved from all other duties, can carry on uninterruptedly a course of study and investigation which supplements in an admirable manner the lectures, dissections, and demonstrations of the college year. As our colleges and universities are situated, it is extremely difficult to give the students, in term-time, any adequate idea of marine forms and their wonderful development,—points which are of great importance in a broad and well-balanced biological education. It is the recognition of this fact which has led to the establishment of marine laboratories along the eastern coast of the United States. In them are learned facts which could be obtained in no other way.

The importance of these laboratories or stations is recognized by every biologist, for in them a large part of the biological instruction is given, and in them a large portion of the original investigation is carried on. It is only a few years since there were none of these regularly established stations. Then the student went to some favorable spot, hired a building or a room on the shore, and conducted his researches with the most primitive apparatus, and under the most discouraging circumstances. In later years there have been various stations established, more or less permanently, and to these students have flocked from all parts of the Union. To show their importance no better example can be taken than the summer laboratory of Johns Hopkins University. This dates almost to the first year of the institution which supports it. It has constantly been conducted by Dr. W. K. Brooks at various points along the coast from the shores of the Chesapeake to the West Indies. The results it has accomplished can be seen by the various publications that have proceeded from it, and the positions now occupied by those

who have availed themselves of the facilities it affords. In amount and character of its biological work the Johns Hopkins University has but few rivals in America, and it is safe to say that at least half of its prominence and prestige in this respect is due to the work done in its marine laboratory.

There is ample evidence that there is an increasing realization of the importance of these summer schools in connection with university instruction. Anything which should tend to lessen the present number would be deplorable. There should be more of them, and more money for their support. Not all institutions have the wealth or have trustees with the breadth of view necessary for the establishment of such stations; and yet similar facilities should be enjoyed by all. In such cases the deficiency should be met either by co-operation or by hiring tables at some established laboratory. As it now is, except the Johns Hopkins Laboratory and that of the United States Fish Commission, all of these stations are supported by individual efforts. The time, however, cannot be far distant when there will be more of these laboratories which will bear an intimate relationship to our colleges and universities. When that time comes biological instruction will be of a higher character, and the biological sciences will take a higher rank in the public estimation than they now do.

RECENT LITERATURE.

Review of Dr. H. Rink's Paper on the East Greenlanders.[1] —The following article is based on a consideration of the interesting conclusions deduced by Dr. Rink in his admirable paper on the East Greenlanders.

The first subject to be considered is the conclusion expressed concerning the original home of the Eskimo.

That Dr. Rink finds evidence tending to confirm the hypothesis that Alaska is the scene of their origin, and supports the statement in the fact that the Eskimo are not strictly confined to the littoral portions of Alaska, but on the mainland thrust themselves along the more important rivers to a greater or less distance, which is in each instance determined by the limit of trees, approaching the coast, along the river-banks. Along the Kus-

[1] Die Ostgrönländer in ihrem Verhältnisse zu den übrigen Eskimostämmen. Von H. Rink. Deutsche geographische Blätter, vol. ix., No. 3, 1886, pp. 228–239.

kokvim and the Yukon Rivers a slight allowance should be made for the constant maintenance of trading-stations situated favorably to induce both the Indians, who dwell in the northern regions, strictly within tree-limits, and the Eskimo, who dwell without it, to trade at those stations.

In three localities the Alaskan Eskimo are known to disperse far into the interior. The first area to be considered is that lying between the Yukon from near the Shgeluk across to the Kuskokvim at Kolmakofsky Redubt and to the sea. This great expanse of barren ground is quite populous with Eskimo. The second and third areas are adjacent, and comprise the region lying east of Kotzebue Sound. Here are the mountain Eskimo and, to the north of them, the Eskimo along the banks of the Kuwuk and several other streams of greater or less importance. The occurrence of these people in each of those localities can certainly form no hypothesis that will tend even to support the assertion that their presence away from the coast should show their origin.

Dr. Rink submits the strange deduction that the Eskimo kaiak is a derivative of the Indian birch-bark canoe. From the earliest accounts every particle of reliable information proves that the most deadly hatred and animosity existed between the Indians and Eskimo wherever they came in contact. Their earlier history is filled with traditions of scarcely credible atrocities practised by each people upon the other; and any one who believes the possibility of the birch-bark canoe being adopted as a model by the Eskimo for his skin canoe has but little knowledge of the contempt of the Eskimo for anything of Indian construction.

Just why the word *umiak* was not substituted and that model considered instead of the birch-bark canoe is incomprehensible. That the umiak is the original of the kaiak is proved by the tradition now existing among the people of Attu, the westernmost island of the Aleutian Chain, and where the writer lived for eleven months.

The narrative is, in substance, as follows: We always had the umiak as a boat for general purposes, used as a vessel for a community or several families. Later, when strife became common, the umiak was made smaller, and only a man and his own family entered it and made it their home for days at a time. They were thus exposed to the inclemency of the weather, and a cover was made over the front as a protection for the family. The place of the man was now drawn nearer the centre, and that left space behind in which could be stored the effects that also required protection. By the act of covering at each end a small space was finally left in which the man could sit, and it was then found that the accompanying members of the family were unnecessary to comfort and speed.

A shaman, who had attained a degree of reverence from his

people and whose decree was law, decided that the women and children should no longer accompany the man in the covered boat, and that the length of the vessel should be that of the fin of the large whale; hence the development of the kaiak, which is essentially a vehicle employed by the men, and not by women and children.

That the kaiak reaches a higher stage of perfection in certain localities depends upon the environment and the means at hand. The clumsiest kaiaks are doubtless those of the region lying between the south side of the Yukon Delta and south to Cape Newenham, on the north shore of Bristol Bay, Alaska. Here the struggle for existence precluded the possibility of devoting time and mental labor in evolving such a craft as is to be found on the shores of Kotzebue Sound and in the perfection of the Greenlander's skin canoe.

The various patterns of construction, as shown by a cross-section of the kaiaks from several localities, indicate that the form is adapted as much to the particular local wants as, perhaps, to the mental scale of the people of each region. The scarcity or the abundance of material for construction of the framework has evidently had nothing to do with the degree of perfection attained, for at the mouth of the Kuskokvim River an unlimited supply of wood may be obtained, while on the west shore of Baffin's Strait or on the shores of Greenland the supply of wood is necessarily limited from the condition of the position.

Traders in Alaska never employ a birch-bark canoe when undertaking a journey, except it be far inland, where if a three-holed kaiak were used and became damaged or worn it could not be repaired for the lack of material (skin) and a knowledge how to perform the work upon a skin canoe. At all of the lower stations where seal-skin is obtainable the kaiak of three holes is employed exclusively, and never the birch-bark canoe. It is rare indeed to find a two-holed kaiak on the mainland waters. Many writers, however, contend that the two-holed kaiak is of prehistoric origin. Such statements are not warranted by facts presented.

The two-holed and the three-holed kaiaks are of Russian invention, and are used only in the sea-otter regions of Alaska or where the sea-otter formerly ranged. The construction of the two-holed kaiak was due to the Russian promish leniks, or, as there intended to mean, the leaders of a hunting-party, who had need for as many men and as few kaiaks as possible when waging war with the neighboring people. It was not a difficult stride to evolve a two-holed kaiak from that having one hole, and after that to create one with three holes in order to accommodate some high functionary who desired to travel in state while two men propelled the affair.

It was afterwards found that so many men had been killed that

youths must be employed to take the place in the rear hole in order that the hunter could cast his dart at the sea-otter, now made doubly wary by the energetic pursuit of it from the increasing number of rival fur companies. As that creature was restricted to certain portions of Alaska, the use of the two-holed kaiak has never gone beyond those limits. The convenience of the three-holed kaiak has made it an accompaniment of the white trader wherever he has gone and been able to procure the skins with which to cover it.

The width of the umiak precluded the probability of the double-bladed paddle being thought of; hence, as the Indian seldom employs the double blade in propelling his birch-bark canoe, it is not difficult to believe that the single paddle was first used and the double blade was devised by an accidental loss of the single paddle, and that the double paddle was evolved from a stick taken from the load of fuel then being carried on the top of the kaiak, which was found to be so effective that its improvement and adoption certainly required but little mental strain.

That some of the Eskimo do not employ the double paddle is well known, and due probably as much through choice as by anything else. Let it be as it may, the art of turning over the kaiak and the occupant righting himself is a diversion practised only where the double-bladed paddle is in common use, and not by all the people using it as a means of propulsion. The Aleuts employ the double-bladed paddle exclusively, and the mainland Eskimo, with the Kadiak Innuit, employ the single blade to as far north as the upper portion of Norton Sound, where an occasional double paddle is used. As far as the mouth of the Mackenzie the single and the double blade are in use through individual or circumstantial preference. East of the latter place the double-blade paddle appears to be the one used exclusively by the Innuit wherever found.

In regard to the development of the various spears, darts, javelins, and other projectiles cast by the use of the arm and the hand-board, Dr. Rink considers them to be developments of the arrow.

The hand or arm was certainly the power to guide and cast a spear or dart long before the flexibility of wood was applied as a means to produce direct motion by the release of a shaft from a string used to create the tension of the bow, even in its crudest condition. If this be true, it is far more probable to conclude the opposite of the deduction inferred by the remarks of Dr. Rink.

If the various projectiles used as means to obtain creatures from the sea, lake, or stream are modifications of the arrow, as understood to be the missile sent from a bow, then it would appear that those weapons now recognized as arrows and everywhere used for land-shooting, except a few instances where the

hunter stands on land and sends that shaft into an object in the water, or where a particular form of arrow is used to transfix a fish while the operator stands in a boat, are the most primitive of all projectiles. It is scarcely credible that such should be the case when all probability points to the simplest form of javelin as the original, and that the arrow is a modification of that weapon.

The bird-spear with three or four divergent prongs on the forward end is certainly an older weapon than the one having that number of prongs situated or affixed near the central part of the wooden shaft. The simple shaft with a single point, or with the later-devised toggle-point, is also an old projectile. The bird-spear having the prongs near the centre of the shaft is then a combination of the original forms of the simple spear and the trident bird-spear.

This combination happily effected the purpose of two weapons in one; for if the kaiaker observed a flock of birds, the combination projectile afforded means of securing them, while if a seal or other mammal thrust its head above the surface of the water, the same instrument, with its shaft of ivory having dentate edges, could be employed to pierce its skin and result in its capture by the hunter, who in these emergencies needed but a single weapon.

It is not, however, uncommon to find the three prongs, or even four prongs, with a central shaft, which is always shorter and subordinate to the long, divergent ones, used for hand-throwing at birds or for transfixing a fish. This form is more commonly reduced in size and employed as an arrow to be projected by the use of a bow of short length, and projected while the kaiaker sits in his skin canoe. The low position of the occupant interferes, however, with the use of the bow while so sitting; hence the employment of that missile did not come into general use.

Some of the projectiles employed by the Eskimo to capture mammals, birds, and fishes have feathered vanes. The material which is used to form the head on the wooden shaft is of such nature that it will curve or distort if not kept at an even temperature. The object of the feathering at the opposite end is to obviate the rotation of the projectile and to produce certainty and steadiness of flight and prevent twisting caused by the curvature of the forward end of the shaft. In other words, the feather-vanes produce the opposite of that which the rifling of a gun is intended to effect. When an Eskimo discovers an object which will afford food or raiment he has no time to lose in nicely adjusting his missile with regard to the curve of the bone or ivory head. It will be readily understood that those weapons which are projected by the bow and the hand-board are the only ones which have feather-vanes attached to them. The feathers for the shafts employed to secure aquatic creatures are taken only from

water-fowl, while the feathers that vane the arrows used to slay land creatures are procured only from land birds. In some localities the feathers of the raven form an exception. Those projectiles which are to be cast by the hand alone never have feather-vanes attached to them, and in many localities the feathering is discarded on the shafts thrown by the hand-board.

In regard to the supposition that the custom of wearing labrets in the lip of the Eskimo is due to and derived from the Indians (Thlinkets) dwelling south of them, this is a conclusion based upon an erroneous conception of the facts in the case.

That the custom of wearing labrets, or lip-studs, is fast disappearing among the Eskimo is not a remarkable thing in itself. An almost entire revolution in customs and manners of far greater significance is not uncommon among nations or peoples farther advanced in our idea of the scale of civilization, or an approach to it. Certainly that those customs which are of least advantage would be the earlier discarded will not be denied by any one. The same remarks are well applicable to the practice of tattooing, which in the eastern regions is not at all general, and in some localities has almost disappeared; yet one of the most profusely tattooed individuals the writer ever saw was an Eskimo woman at Fort Chime, Ungava; other women there were unmarked by tattooing. This remarkable instance was due simply to the fancy of the individual performing that operation upon a subject who had no will in the matter, and for that reason should not be taken into sufficient consideration to form a theory or a generalization on. Yet how unfortunate for science if an exploring expedition had touched at a locality where this woman and her husband had happened to be the only ones of the Innuit of the region seen and she be the subject of an elaborate discussion, which a fertile mind would generalize into a universal custom!

To return to the custom of wearing the labret, or lip-stud. It seems just as probable that the practice of perforating the lip and inserting a piece of stone, bone, or ivory had its origin in the east, and that they should be the first to discard it and the western Eskimo the last to relinquish it. It is a well-recognized fact among those people that the labret seriously interferes with the chewing of tobacco, for the stud must be removed, and this permits the saliva to flow from the orifice. This flow freezes in winter and results disastrously to the person. Hence the love of ornamentation has been subordinated to the gratification of an acquired habit of a character originating but recently. The very abruptness in the Mackenzie region of wearing the lip-stud tends to prove that the lack of intercommunication between the widely-separated people termed Eskimo has served to perpetuate the custom to the westward.

That the Thlinket should originate a custom now adopted by

the western Eskimo is scarcely borne out by a consideration of other facts that may be adduced to prove the contrary. The form and position of the Thlinket lip-stud is not copied by any of the Innuit. The latter perforate the lip directly under the corner of the mouth, while the former pierce the median line of the lower lip.

All of the traditions, legends, and speech of the western Innuit point to an eastern origin, and that the route lay by the sea and northern land. Their extension southward was partly a matter of choice and as much so of necessity. When they came in contact with the Thlinket and ceased their wandering, why should not the Thlinket as a propitiatory measure have adopted a custom of the Innuit, but modify the position and form as well as go only half-way and wear but one lip-stud?

In regard to the material of construction, form of the dwellings, and the disposition of the fireplace, Dr. Rink advances some arguments which should be taken into consideration.

A tradition exists among the Unalit of Norton Sound to the effect that the ancestors of the present people constructed dwellings of sod, earth, and stones, when each of those materials was at hand. Now the greater portion of the western Eskimo dwell in fixed habitations composed of logs set on end or laid one above the other to a sufficient height and banked nearly to the eaves with dirt. The convenience of the material employed is evident; hence the transition from the former character of dwelling to that of the present needs no discussion. The position of the fireplace in their present habitations is that tending to an economy of space and for the convenience of the occupants. The light-hole, which forms also the place of exit for the smoke of the fire within, is placed in the centre of the roof, so that the rays of light may diffuse themselves equally on all sides of the room within, while if the fire were built at one side the smoke-hole would be placed directly over it, and this would tend to cause crowding around that particular portion in order to obtain the advantage of the most light in the short days of the long winter.

The form of the house is consistent with the character of the material used in its construction. Rough-laid stones without cement or mortar would tend to fall if arranged in walls to form a square or oblong; but if the arrangement be circular or dome-shaped, then the pressure would be equal on all parts; and where the material is of sufficient firmness to withstand a crushing strain, the best adapted form is that of the dome.

The common snow hut of the eastern and northernmost Innuit is constructed on that principle, for the simple reason that no other form would support the weight. This shape tends to prevent additions or intercommunicable chambers, except of a less specialized character; and not until the use of wood was

adopted do we find that several chambers or dwellings are so placed as to cluster on at least three sides about the original structure, which insures by this arrangement additional protection and proximity. There are many facts to adduce in support of the clustering character of the dwellings, but as they involve so many considerations, a discussion of them will be deferred for another occasion.

Where wood is scarce and large pieces are met with but few times in the course of an Eskimo's life, those few large pieces are reserved to furnish him with props or supports for his tent in summer, or for the frame of his umiak, or the shafts of his spears and other necessities, which are greater to him than fuel to cook his food or to make warmth. There the turf or stone-walled hut is the kind of dwelling, while the snow hut is from its nature a winter edifice only.

The Eskimo of Southern and Western Alaska know of the snow hut only by tradition. Only in the extreme northern part of Alaska do we begin to find the snow-blocks employed as material from which to construct a dwelling; thence eastward the use of that substance is common as far as the Eskimo extend.

None of the Eskimo south of Hudson Strait erect permanent dwellings for themselves, with the exception of those directly and continually in contact with the white people (missionaries) of Labrador. The only shelters are the skin tent and the snow hut. In many places there are traces of former habitations of stone and turf; the two materials having been apparently combined, for the disposition of the ruins indicates an insufficient quantity of either material by itself. Instead of the huge *kazhgnk*, or "club-house," of the western Innuit, a large, oblong space is walled with blocks of snow, and within the inclosure repair those who participate in the festivals and dances commemorative of the return of the sun from the south. At the same season the practice of distributing presents to the living in honor of the dead also takes place; but as this latter ceremony occurs only every fourth year in any locality, the honoring of the dead and change of names is held previous to the dances, in propitiation of the light-giving principle.

A discussion of the linguistic affinities and the correlation of the myths, legends, traditions, and beliefs, which go far in the character of the Innuit, will be deferred for a separate article.

To Dr. Rink the legion of ethnologists cannot fail to express their admiration of his description of research and the practical advantages to be gained therefrom; and it is earnestly hoped that the publication of the entire results of the recent expedition to the locality of the East Greenlanders will not be long delayed. —*L. M. Turner, Smithsonian Institution*, April 11, 1887.

RECENT BOOKS AND PAMPHLETS.

Jordan, D. S. } Review of the Genera and Species of Julidinæ found in
Hughes, Elizabeth G. } American Waters. Proc. U. S. Nat. Mus. From the authors.

Jordan, D. S. } List of Fishes collected at Arkansas, Indian Territory, and Texas.
Gilbert, C. H. } Proc. U. S. Nat. Mus. From the authors.

List, J. H.—Zur Kenntniss der Drüsen in Fusse von Tethys fimbriata. Ext. Zeit. wiss. Zool., 1887.—Zur Herkunft des Periblastes bei Knochenfischen (Labriden). Ext. Biol. Centralbl., 1887. Both from the author.

Packard, A. S.—Over the Mexican Plateau in a Diligence. Ext. Bull. Am. Geog. Socy., 1887.—Hauser on the Organs of Smell in Insects. Ext. Am. Nat., 1887. Both from the author.

Shufeldt, R. W.—Contributions to the Anatomy of *Geococcyx californianus*. Ext. Proc. Zool. Socy. London, 1886.—Additional Notes on the Anatomy of the Trochili, Caprimulgi, and Cypselidæ. Ext. Proc. Zool. Socy. London, 1886.—The Veterinary Service of the United States Army. Ext. Jour. Comp. Med. and Surg., 1887. All from the author.

Thompson, E. H.—Archæological Research in Yucatan. Ext. Proc. Am. Antiq. Socy., 1886. From the author.

American Society of Microscopists.—Proceedings of the Ninth Annual (Chautauqua) Meeting. 1886. From the Society.

Fewkes, J. W.—A New Rhizostomatous Medusa from New England. Ext. Am. Jour. Sci. From the author.

Boehm, G.—Ueber das Alter der Kalke des Col dei Schiosi. Berlin, 1887. From the author.

State Legislature (Ohio).—Fifth Annual Report of the Ohio Agricultural Experiment Station. Columbus, 1887. From the State Commissioners.

Bennett, W.—On the Affinities and Classification of Algæ. Ext. Linnean Soc. Journ., 1887. From the author.

Lueders, F. G. J.—A Memorial to the Representatives of Physical Astronomy. Madison, Wis., 1887. From the author.

Society of Science, Letters, and Art.—The Jubilee number of the Journal of the Society of Science, Letters, and Art, Jan.–July, 1887. From the Society.

Putnam, F. W.—Conventionalism in Ancient American Art. Ext. Bulletin Essex Inst., 1886. From the author.

Putnam, F. W.—Twentieth Annual Report of the Peabody Museum. Cambridge, 1887.

Smithsonian Institution.—Annual Report of the Board of Regents to July, 1885. Part I.

Bourne, G. C.—The Anatomy of the Madreporarian Coral Fungia. Reprint Quart. Jour. Mic. Science, Jan. 1887. From the author.

Woodward, A. S.—On Leathery Turtles, Recent and Fossil, and their Occurrence in the British Eocene. Rep. Proc. Geol. Assoc., vol. x., No. 1. From the author.

Lydekker, R.—On Certain Dinosaurian Vertebræ from the Cretaceous of India and the Isle of Wight.—On a Molar of a Pliocene Type of Equus from India. Both from Quart. Jour. Geol. Soc., May, 1887.—Notes on Chelonia from the Purbeck, Wealden, and London Clay. Ext. Geol. Mag., June, 1887. All from the author.

Lawrence, G. N.—Descriptions of New Sylviidæ, Troglodytidæ, and Tyrannidæ.—Description of a New Thrush from Grenada, W. I. Both from Ann. N. Y. Acad. Sci.—The Rediscovery of Bachman's Warbler. From the Auk. Jour., 1887. All from the author.

Forbes, S. A.—The Lake as a Microcosm. 1887. From the author.

Dawkins, W. B.—The British Pleistocene Mammalia. Part VI., Cervidæ. Printed for the Palæontographical Society, London, 1887. From the author.

Hughes, N. C.—Genesis and Geology. Chocowinity, N. C. From the author.

Wells, J. G.—A Catalogue of the Birds of Grenada, W. I., with Observations thereon.

Vasey, G.—Grasses of the South. Dept. of Agriculture. Bulletin No. 3, 1887. From the Department.

Meyer, O.—On Invertebrates from the Eocene of Mississippi and Alabama. Ext. Proc. Nat. Sci. Phil., 1887. From the author.

Foerste, A. F.—Flint Ridge (Lower Coal-Measure) Bryozoa. Ext. Bull. Denison Univ., 1887. From the author.

Mills, T. W.—Life in the Bahamas. Repr. Can. Rec. of Science, April, 1887. From the author.

Dana, J. D.—Note on the Views of Prof. Emmons on the Taconic System. Amer. Jour. Sci., May, 1887. From the author.

Gilbert, G. K.—Special Processes of Research. Presidential Address before Amer. Soc. of Nat., 1886. From the author.

Osborn, H. F.—The Upper Triassic Mammals Dromatherium and Microconodon. Ext. Proc. Phil. Acad. Nat. Sci., Apr. 1887.—The Origin of the Corpus Callosum. Part II.—Morphologisches Jahrbuch. Band. xii. Both from the author.

Trouessart, E. L.—Diagnoses d'Espèces nouvelles de Sarcoptides plumicoles (Analgesinæ). From the author.

Schlosser, M.—Erwiederung gegen E. D. Cope. From the author.

Pohlman, J.—The Human Teeth viewed in the Light of Evolution. Buffalo, 1887.—The Niagara Gorge. Proc. A. A. A. S., 1886. Both from the author.

Walcot, C. D.—Second Contribution to the Studies of the Cambrian Faunas of North America. Bull. U. S. Geol. Surv., No. 30, 1886. From the Department.

Scudder, S. H.—Systematic Review of our Present Knowledge of Fossil Insects, Myriapods, and Arachnids. 1886. Bull. U. S. Geol. Surv., No. 31. From the Department.

Peale, A. C.—Lists and Analyses of the Mineral Springs of the United States. Bull. U. S. Geol. Surv., No. 32, 1886. From the Department.

Diller, J. S.—Notes on the Geology of Northern California. Bull. U. S. Geol. Surv., No. 33, 1886. From the Department.

Giles, C.—The True and the False Theory of Evolution. Phila., W. H. Alden, 1887. From the author.

Pavlow, Marie.—Études sur l'Histoire paléontologique des Ongulés en Amérique et en Europe. 1. Groupe primitif de l'Éocène inférieur. Moscou, 1887. From the author.

Stevenson, J. J.—Notes on the Surface Geology of Southwest Virginia. Am. Philos. Soc., 1887. From the author.

Smets, G.—Un Reptile nouveau des Sables d'Aix-la-Chapelle.—Une Épine dermique fossile des Sables d'Aix-la-Chapelle. 1887. Both from the author.

Claypole, E. W.—Organic Variation not Definite in Direction. An Outcome of Environment. Amer. Philos. Soc., 1887. From the author.

Shufeldt, R. W.—A Critical Comparison of a Series of Skulls of the Wild and Domesticated Turkeys. Ext. Jour. Comp. Med. and Surg., July, 1887.—Notes on the Visceral Anatomy of Certain Auks. Ext. Proc. Zool. Socy. London, 1887.—Observations upon the Habits of *Micropus melanoleucus*, with Critical Notes on its Plumage and External Characters. Ext. Ibis, 1887. All from the author.

GENERAL NOTES.

GEOLOGY AND PALÆONTOLOGY.

On the Glacial Flow in Iowa.—There is evidence of at least three ice-flows, or advances, of the glacial sheet in Iowa:

First, from the northeast; second, from the northwest, as recognized by Dr. C. A. White;[1] and, third, from the north.[2] The evidences of these flows are found in the striated rocks, the transported materials, and the moraines.

The first glacial flow, so far as we have present record of it, was from the northeast to the southwest. Native copper and iron ore have been found in the drift in the extreme northern as well as the extreme southern part of the State, in irregular lumps of a few ounces or a few pounds in weight.

One lump of iron ore, found by E. W. Jacobs, Esq., in the drift, in the northern part of Cerro Gordo County, weighed slightly over six pounds, while lumps of copper from the drift of the western part of Floyd County weighed from three ounces to as many pounds. One lump of copper found in Lucas County[3] weighed upward of thirty pounds; and specimens much smaller have been found in other portions of the State.

These specimens are, in all respects, like the native copper and iron ore from the mines in the Lake Superior region; and hence, as Dr. White observes, they were probably derived from this region.

"On account of the friable nature of a considerable part of the rocks of Iowa, or the facility with which they have become disintegrated, the grooves and the scratches of the glacier which were once doubtless abundant upon them have, to a considerable extent, become obliterated."[4] "For this reason, together with the fact that the drift so generally and deeply covers those surfaces which probably yet preserve such traces, we very seldom have an opportunity to observe them in Iowa."[4]

Nevertheless, the surface of the upper carboniferous limestone on the west side of the Missouri River, opposite Council Bluffs, shows glacial scratches having a direction south, 41° west.[5] These facts seem to imply the existence of a glacial current or flow, during some part of the glacial period, having a southwesterly direction.

[1] White's Geology of Iowa, p. 91.

[2] So far as we have knowledge of, at the present time, this seems to have been the chronological order of the ice-flows within the borders of this State.

[3] White's Geology of Iowa, p. 96. [4] Ibid., p. 93. [5] Ibid., p. 94.

The second glacial current was from the northwest to the southeast. We appear to have sufficient evidence of its direction in the glacial scored rocks, and the boulders found in the drift in different portions of the State.

The direction of the striæ observed upon the Burlington limestone, near Burlington, in the extreme southeastern portion of the State, was south, 22° east.[1]

Up to last year, this was the only locality known in Iowa where the rock surface still preserved unmistakable evidence of a southeasterly flow of the ice. But in September last, while making examinations of the Devonian limestone in the west bank of the Iowa River, at Iowa City, evidence of glacial action was observed, and upon removing the incumbent drift and loess, the surface of the rock was found to be most beautifully planed and scored by glacial action. The size of this surface was ten feet by sixteen feet, and the parallel striæ have the direction south, 73° east. Near the centre of this surface[2] one large groove was about ten feet in length and four feet in average width. As much of this rock has been removed in quarrying, it is impossible to ascertain the exact original extent of this groove. It has a depth, on the south side, of eighteen inches, while the bottom slopes gradually upward to the north; and what is of peculiar interest is the fact that the bottom, and particularly the north side, is beautifully smoothed and striated, while the south side, which is very abrupt, shows scarcely a trace of the smoothing and striating action of the ice. The trend of this groove is north, 69° east. The north side of the groove presents several distinct sets of striæ, the bearings of two of the more prominent of which were taken, with the following results:

First, north, 36½° east; second, north, 40° east, with a slope of 13½° upward. This groove was formed by a portion of the ice which seems to have been deflected from its normal course at this point.

About one hundred and forty yards south of this another surface was uncovered which presented seven or eight distinct sets of striæ. The bearings of five of the principal sets of striæ were taken, with the following results:

No. 1, south, 60° east.
No. 2, south, 85½° east.
No. 3, north, 83½° east.
No. 4, south, 80½° east.
No. 5, north, 71½° east.

The great variation in the direction of the striæ at this point is believed to have been caused by a deflection of the relatively thin ice from its normal course by some local obstruction.

[1] White's Geological Survey of Iowa, p. 94. In these cases no allowance is made for magnetic variation.

[2] The surface is from thirty to forty feet above the water in the Iowa River.

Fifty feet to the south of the above the rock presents an equally beautiful scored surface, having, however, but one set of striæ, with a direction south, 70° east.[1]

In the drift which immediately overlies the rock at this place a boulder of red Sioux quartzite, weighing about one hundred pounds, was found; and on the opposite side of the river another of the same material somewhat larger. Large boulders of the same material have also been found in considerable abundance in the drift for a distance of fifteen miles north from this locality. These boulders are in all respects identical, lithologically, with the red Sioux quartzite exposed in the extreme northwestern corner of the State, and were, without doubt, derived from that region. This evidence, together with the fact that the red Sioux quartzite boulders are found in greater or less abundance in both the western and southern portions of the State,[2] seems conclusive evidence that the ice-flow, at this period of the glacial epoch, had a more easterly direction than has been heretofore supposed.

The evidence of the third, or last, advance of the ice-sheet in Iowa is found in the moraines, which extend nearly across the western portion of the State from north to south. "These may be described as two great loops, one within the other, and with nearly parallel sides."[3]

The *outer moraine* may be approximately located as follows: Beginning a little west of the north line of Osceola County, in the north part of the State, it extends first eastward to Spirit Lake, in the northeast part of Dickinson County; thence south, curving around east of the Little Sioux River, to Storm Lake, in Buena Vista County; thence in a general southeasterly direction to near the northeast corner of Guthrie County; "thence along the Middle and South Raccoon into the north part of Madison County;"[3] thence curving to the east and northeast, "entering Jasper County;" thence to the north, which course is pursued until Clear Lake, in the west part of Cerro Gordo County, is reached; thence to the northeast, cutting across the northwest portion of Worth County, and entering Freeborn County, Minnesota, about midway between its east and west lines.

The *inner moraine* enters Iowa from the northwest, slightly west of Spirit Lake. It passes southeast with, and parallel to, the outer moraine into the western part of Palo Alto County, but instead of curving to the west from that point and continuing parallel with the former, it pursues a southeasterly course

[1] In all the above bearings an allowance of seven degrees is made for the variation of the magnetic needle.

[2] White's Geological Survey of Iowa, vol. i. p. 91.

[3] Prof. J. E. Todd, Iowa Hort. Rept., vol. xviii.

through Pocahontas and Webster Counties to the northwest corner of Boone County; thence eastward to the north-central portion of Story County; thence north into southwest Franklin County, and from that point to the northwest through Wright and Hancock Counties to Forest City, in the southeast part of Winnebago County; thence to the northwest to the northeast corner of Kossuth County; thence curving to the southeast, "forming an interlobular portion to the east side of Winnebago County;"[1] thence uniting with the *outer* moraine, as it cuts across the northwest portion of Worth County, and enters Freeborn County, Minnesota.

"These moraines are linear bends of knobby drift, and structurally are developments of the till, having similar features with it, except that their altitudes are exaggerated."[1] They were formed by an extension or "finger" of the main mass of ice at the north; the one which formed the outer moraine reached a point some distance south of Des Moines, but there stopped in its course by the action of the warm south winds and the sun, which soon caused it to retreat to the north, beyond the limits of the State; but only to again advance at a colder period, but this time with diminished volume, and to be soon driven back again by the winds and the sun.

By the second advance of the ice-sheet the inner moraine was formed.

An extended study of the drift and loess formations of the entire State would doubtless throw much additional light upon the evidence of the ice-flows and the condition of things within the borders of the State during and at the close of the glacial epoch.—*Clement L. Webster, State University, Iowa.*

MINERALOGY AND PETROGRAPHY.[2]

Petrographical News.—Very recently Professor Judd[3] has undertaken to show that his schillerization theory[4] is founded upon well-known facts. In addition to the planes of least cohesion (cleavage planes) and the gliding planes, there is a third series of planes in crystals,—the solution planes, along which the solution of the crystal takes place most readily. These are distinct from either the cleavage or the gliding planes, and their position in the crystal is dependent upon its symmetry. When a crystal fragment is subjected to the action of a solvent, solution begins along these planes, little irregular-shaped hollows appear, and as these grow larger they assume the form of negative crystals. These hollows gradually become filled with secondary substances, and in this way arise the inclusions, which

[1] Prof. J. E. Todd, Iowa Hort. Rept., vol. xviii.
[2] Edited by Dr. W. S. BAYLEY, Madison, Wisconsin.
[3] American Naturalist, Dec. 1885, p. 1216.
[4] Geological Magazine, vii., Dec. 1886, p. 81.

produce the peculiar schimmer on faces of the crystal parallel to the planes along which the inclusions are arranged,—*i.e.*, the solution planes. After showing that secondary solution planes may be produced in directions parallel to directions of pressure, as in the case of a faulted quartzite pebble, and that the repeated twinning of a mineral may also give rise to them, the author describes various stages in the process of schillerization, as seen in thin sections under the microscope. This theory is not intended to apply to all cases of inclusions arranged in definite planes in minerals, but only to those which at the same time show some indication of regularity of form, as in Labradorite, hypersthene, etc.——On the road between Verrex and St. Vincent, in the Val d'Aoste, Professor Bonney[1] has found a schistose glaucophane-eclogite interbedded with quartz-mica schists, limestone, and green schists. The rock consists of pale wine-red garnets, with inclusions of hornblende, glaucophane, and dust, a green hornblende, glaucophane both in irregular grains and in well-developed crystals, epidote, mica, and sphene (leucoxene). In this connection the author describes in some detail the glaucophane-gabbro of Pegli, near Genoa. This rock was described by Williams[2] as an amphibolite, but Bonney prefers calling it gabbro. The glaucophane appears to have been secondarily derived from diallage.——Specimens of kaolinized granite from St. Austell, Cornwall, indicate to F. H. Butler the close association of tourmaline with the progress of the alteration in the original granite.——According to Professor Bonney,[3] the Ranenthal serpentine is not the result of the alteration of amphibolite, as was supposed by Weigand,[4] but has been derived from an olivine-hornblende rock resembling certain pircrites. To this view Mr. Teall takes exception. He states[5] that his examination of the rock confirms the deductions of Weigand, and that the serpentine is the product of the alteration of hornblende.——The elastic sandstone of Delhi, Germany, according to O. Mügge,[6] is composed of quartz grains intricately interlocking, and a very little interstitial clayey material. Most of the cement has been removed by the action of percolating waters, and in the interstices thus left the individual quartz grains have grown by the addition of silica in crystallographic continuity with the substance of the original grains. This growth, however, ceased before the occupancy of the entire space. It is to the abundance of these cells that the sandstone owes its elasticity.——Gorman mentions the occurrence of phillipsite, chabasite, and apophyllite in the vacuoles of the basalt

[1] Geological Magazine, vii., July, 1886, p. 1.
[2] Neues Jahrb. f. Min., 1882, ii. p. 201.
[3] Geol. Magazine, Feb. 1887, p. 65.
[4] Min. u. Petrog. Mitth., 1875, p. 175.
[5] Geol. Magazine, March, 1887, p. 137.
[6] Neues Jahrb. f. Min., 1887, i. p. 195.

of Prudelles, Puy-de-Dôme.[1]——A mica-gneiss similar to the granulite of Törnebohm is described by Sjögren[2] as occurring in the iron regions of the Banat. Sjögren finds that the ores are not connected genetically with the intrusion of banatite, as has heretofore been supposed.——In his geological sketch of part of the Galician-Hungarian East Carpathians Dr. H. Zapalowicz[3] gives a few notes on the schists and intrusive rocks occurring in the more mountainous regions of the Carpathians.

Mineralogical News.—*Stüvenite* is the name proposed by Darapsky[4] for a mineral from the Alcaparroso Mine, near Copiapó, in Chile. Its analysis yielded:

So_3	Al_2O_3	MgO	Na_2O	K_2O	H_2O
36.1	11.6	1 0	2.7	trace	47.6

This corresponds to a composition represented by the formula $(\frac{1}{2}Na_2\frac{1}{2}Mg)So_4 + Al_2(So_4)_3 + 24H_2O$. The mineral occurs in acicular crystals grouped in radial masses. Before the blowpipe it presents the features of the alums, to which group of minerals the new substance probably belongs.——In the same paper in which stüvenite is described Darapsky records the results of the analyses of a large number of Chilian alums, principally of the feathery variety, and gives a list of all the alums investigated up to the present time. These he divides (following Dana) into the regular alums and the halotrichites, to which subdivision the above-noted stüvenite belongs. The names of seventeen distinct minerals are included in the list.——Hintze[5] proposes *arsenolamprite* as the name for Chilian arsenic, which possesses physical properties different from those of ordinary arsenic. The composition of the mineral is:

As	Fe	SiO_2	
98.20	0.96	0.30	(Mean of two analyses).

Specific gravity equals 5.50. It is soft, and of a brilliant metallic lustre. It is probably identical with the arsenglanz of Breithaupt, from Marienberg, in Saxony.——In 1881 Luedecke attempted to show that *mesolite*, *natrolite*, and *scolecite* form an isomorphous-trimorphous group, the first mineral crystallizing in the orthorhombic, monoclinic, and triclinic systems, natrolite in the orthorhombic and monoclinic, and scolecite in the monoclinic and triclinic systems. C. Schmidt[6] recently having the opportunity to reinvestigate the crystallography of scolecite, declares that this mineral crystallizes only in the monoclinic system, and that the triclinic variety described by Luedecke was

[1] Comptes Rendus, civ. p. 719.
[2] Jahrb. d. k. k. geol. Reichsaust, 1886, p. 607.
[3] Ib., p. 361.
[4] Neues Jahrb. f. Min., 1887, i. p. 125.
[5] Zeits. f. Kryst., xi. p. 607. [6] Ib., p. 587.

probably merely a monoclinic twin, whose twinning plane is the clinopinacoid. Since Rammelsberg[1] has shown that the orthorhombic mesolite (galactite) is probably natrolite, and since this mineral is found only in orthorhombic crystals, there has as yet been no proof given to show that either of the three minerals mentioned crystallizes in more than one system.——A. Becker[2] has analyzed *alstonite* and *barytocalcite* from Alston Moor, in order to decide as to whether Groth's view in regard to the composition of these substances is well founded. Both minerals are carbonates of calcium and barium, alstonite crystallizing in the orthorhombic system, and barytocalcite in the monoclinic. From the fact that calcium carbonate has never been found in monoclinic crystals, whereas, on the other hand, an orthorhombic variety is well known, Groth supposed that alstonite is an isomorphous mixture of the carbonates of barium and calcium, while barytocalcite is a molecular compound of the formula $BaCa(Co_3)_2$. Becker's results indicate the truth of this supposition. The composition of alstonite may be represented by $BaCa(Co_3)_2$; that of barytocalcite by $\times BaCo_3 + \gamma CaCo_3$.—— In the ruins of old mines in the neighborhood of the Windgälle, in Canton Uri, Switzerland, are found oolitic masses composed of a brown or green substance in little elliptical and lenticular grains cemented together by carbonate of lime. These little grains are themselves made up of scaly magnetite and a bright-green, weakly-dichroic mineral,[3] with aggregate polarization. This was separated by Thoulet's solution, freed as perfectly as possible from the associated carbonate, and subjected to analysis, with the following result:

SiO_2	Al_2O_3	FeO	MgO	H_2O
25.23	19.97	37.51	4.39	12.90

Upon comparison of these figures with those found by Bovicky for the *chamoisite* from Chrustenic, in Bohemia, the two minerals were found to be almost identical in composition, after allowing for the impurities in the Chrustenic mineral. Chamoisite is thus shown to be the alumina-rich and ferric-iron-free member of the series to which cronstedtite and thuringite belong.——R. Sharizen[4] has studied the physical properties of *monazite* from a pegmatitic granite-vein near Schültenhofen, in the Böhmerwald. He finds it to crystallize in the monoclinic system, with an axial ratio 0.9735 : 1 : 0.9254. The inclination of the $\dot{a}$ to the $\dot{c}$ axis is 103° 37′. The plane of the optical axes is perpendicular to the clinopinacoid, and the acute bisectrix, which is positive, is in the obtuse angle β, and is inclined 5° 54′ to the vertical axis. The optical angle $VV = 12° 44'$ for yellow light, and the indices of refraction $\beta = 1.9465$ and $\gamma = 1.9285$.——The ferric sulphate

[1] Mineralchemie, ii., Aufl. 2, p. 633.
[2] Zeits. f. Kryst., xii. p. 222.
[3] C. Schmidt, ib., xi. p. 597.
[4] Zeits. f. Kryst., xii. p. 253.

botryogen, from Fahlun, in Sweden, has been examined by Hockauf.[1] The mean of two analyses yielded:

So_3	Fe_2O_3	FeO	MnO	CaO	MgO	H_2O
36.94	16.38	2.23	1.93	0.90	7.63	33.99,

corresponding to the formula $FeSo_4 + [Fe_2(So_4)_3 + (FeO)_2So_4]$. The botryogen of commerce was also analyzed, and found not to have the composition of the genuine mineral.

Crystallographic News.—In an article on hemimorphic pyrargyrite twins from Andreasberg, Schuster[2] discusses the classification of twinned crystals, and defines them as symmetrical or unsymmetrical. The symmetrical ones he subdivides into those hemitropically developed and those which show no hemitropism. The hemitropic symmetrical twins include those of holohedral and of certain hemihedral and hemimorphic minerals. The unsymmetrical and the non-hemitropic symmetrical classes embrace the twins of those minerals which crystallize in the inclined and trapezohedral-hemihedral divisions of the different systems, and also certain hemimorphic minerals. Examples are cited to show the application of the terms of this classification to the description of complicated twins.——As the result of new investigations with the Bertrand[3] microscope and lenses, Des Cloizeaux[4] finds that the mineral which bears his name crystallizes in the orthorhombic system.——Cathrein[5] describes crystals of orthoclase in the pores of granite at Predazzo, which have their largest development in the direction of their $\dot{a}$ axis.——The same author mentions twinning striations parallel to the octahedral edges of magnetite from Fürtschlagl, in the Zillerthal.

Miscellaneous.—J. Lehmann[6] explains the perthitic structure of certain of the feldspars by supposing that one of the minerals, as albite in perthite, is secondary, and fills cracks in the other. The cracks he further supposes to be occasioned by contraction in the original mineral, in consequence of sudden cooling, etc. He shows, by experimenting on a large number of different minerals, that this cracking takes place, under certain conditions, not in the direction of the cleavage, but in some other direction,—usually at right angles to the most perfect of all the cleavages. In the case of orthoclase, in which the cleavages are parallel to $\infty P\bar{\infty}$ and oP, the cracking takes place parallel to $\infty P\infty$. After formation in this manner the cracks are enlarged by the action of solvents and the secondary substance is deposited in them. ——The indices of refraction for topaz from the Urals, anglesite from Monte Poni, in Italy, sphalerite from Spain, and harstigite from Pajsberg have been recalculated by Ramsay,[7] from data

[1] Zeits. f. Kryst., xii. p. 240. [2] Ib., p. 117.
[3] Bull. d. l. Soc. Min. de France, 1885, pp. 29, 377, and 426.
[4] Zeits. f. Kryst., xii. p. 178. [5] Ib., xii. p. 34. [6] Ib., xi. p. 608. [7] Ib., xii. p. 209.

furnished by the method in which prisms with large refractive angles are used. The method consists essentially in determining the refractive index of a mineral prism enclosed in a highly-refractive medium.——A few years ago Pfaff found that certain regular and uniaxial minerals possessed interfacial angles, which differed from their calculated values by some few minutes. He ascribed this irregularity to the tension producing optical anomalies, but did not show that the crystals measured were optically anomalous.——Brauns[1] has measured isotropic and doubly-refracting lead-nitrate, spinel, and ammonium-alum. He compares the deviations from the true values of the interfacial angles of the isotropic varieties with the deviations noted in the cases of the doubly-refracting varieties, and arrives at the conclusion that a difference between the angles of singly- and doubly-refracting regular crystals does not exist.

BOTANY.[2]

The National Herbarium.—The botanists of the country have for some years shown an increasing interest in the botanical work of the Department of Agriculture at Washington. This interest has, without question, been of great benefit to the Department, and has probably been the chief factor in calling into existence the "Division of Botany." The Botanical Club of the American Association for the Advancement of Science has doubtless been one of the agents in developing this interest and directing it into useful and effective channels. This work of the club, if it accomplished nothing more, would fully justify its existence.

Now, let the botanists continue their efforts for the advancement of the botanical work in Washington. Let there be a demand for adequate provision for the increase of the Herbarium. There should be an ample appropriation for the investigation and collection of plants in little-known or little-visited localities. It is well known that the Herbarium is wanting in many things which can be obtained only by sending men into the field commissioned to secure certain material. The intelligent and liberal policy of the authorities in respect to the entomological work of the Department, whereby local entomologists in different parts of the country have been set to work for the benefit of the "Division of Entomology," should be imitated on the botanical side. There are many excellent collectors who might be detailed each season to thoroughly explore certain localities at comparatively little expense, while the results would be of vast benefit to the botany of the country.

Some such plan as this must be adopted if anything at all is to be done for botany. The government surveys appear to have

[1] Neues Jahrb. f. Min., 1887, i. p. 138.

[2] Edited by Prof. CHARLES E. BESSEY, Lincoln, Nebraska.

ceased entirely even the little attention they formerly bestowed upon the plants of the country. Unless the botanists can secure some aid for the Herbarium, systematic botany will suffer grievously in the national capital. While the government is doing so much for science in geological, mineralogical, and anthropological explorations, ought it not to foster also the science of botany, which for its own sake may make equal demands with other sciences, but which may also make special demands because of its close relation to the agricultural interests of the country at large?—*Charles E. Bessey.*

A Duty of Botanists.—Every botanical teacher has in his classes some young men and women who have the desire to become botanists. The number is doubtless relatively small, the great majority in every class taking but a transient interest in botanical science; but as it is from this small number that the working-force of the botanists of the future is to be recruited, these embryo botanists should receive especial attention from teachers.

What should be the preparation of the young man or woman who proposes to enter the field of botany? An examination of a great many college-catalogues shows that in many places there are vague ideas indeed as to what preliminary or supplementary training a botanist should have. In some colleges one might suppose that those in authority imagined botany to be bounded by and included within the ordinary little text-books used in the class-room. I have in mind now some colleges where (as advertised in their catalogues) particular attention is given to botany, and where there are "post-graduate courses of study," leading to the Master's Degree, in which there is no hint whatever that the literature of botany is not all to be found in English books. Not a word of German, no French, no Latin, is indicated as necessary for the young people who pursue even the "post-graduate courses" in botany. Let not the botanists in the better-ordered colleges say that such cases are exceptional. They are not exceptional, as may be easily demonstrated by any one who will take the trouble to examine the catalogues of a considerable number of colleges.

What can a young man do in any department of botany who cannot read German, French, and Latin? The literature of Vegetable Anatomy and Physiology can only be known to him in the meagre translations of men fortunately better trained than himself, while the mass of the literature of systematic botany must forever remain sealed to him, for in this part of the field there are no translations of the great books. What will such a badly-equipped man do with Bentham and Hooker's "Genera Plantarum," DeCandolle's "Prodromus," Walper's "Repertorium," Müller's "Annales," DeCandolle's "Monographiæ Phan-

erogamarum," etc., etc.? Or, suppose he is a student in one of the agricultural colleges, what more fitting subject for him than the thorough study of the grasses, or the injurious fungi? But what can he do in the first case without the ability to use Stendel's "Synopsis Plantarum Graminarum," the works of Kunth, Trinius, Nees, Häckel, or, in the second case, the works of Fries, Persoon, Rabenhorst, Winter, etc.?

There are other grave faults in most of the courses of study in which young botanists are supposed to be getting their training, but this fault of inadequate language preparation is the one perhaps most easily remedied. Should not every teacher of botany use every means possible to bring about a change for the better in this particular? Should not every young botanist be trained in at least the three languages I have mentioned,—German, French, Latin? And is it not the duty of the teachers of botany to see to it that their colleges make provision for such training? Where the authorities will not make such provision, is it not the duty of the teacher of botany to candidly advise the young botanist to go to some other college where necessary preliminary training is not ignored?—*Charles E. Bessey.*

The Element of Time in Botanical Study.—In the arrangement of courses of study it should be borne in mind that the beginner in botany requires more time than is usually allotted to the subject of elementary botany. In fact, it may be said that more time is necessary for botany of any kind or grade than is given to it in ordinary courses of study. In most cases, still, botany occurs as a daily study in the spring term of some school year, often the freshman year in colleges, and this dose (for such it is) is, in many instances, repeated a year or two later. In high schools it is rarely the case that botany receives more time than is afforded by a single spring term.

Now, it must be remembered that botany is a science of observation, and that botanical study on the part of the pupil must consist largely of training and practice in the observation of plants. Nowadays but few teachers are willing to teach botany as a text-book study alone. The pupil is expected to learn about plants by the study and observation of plants rather than by the conning of books. But learning to observe is slow work. One cannot become an observer by simply being told to observe; nor can he become a close observer by a few weeks' hurried practice. A good deal of time is required. The pupil's faculties must have time in which to grow. Just as the learner must have time, extended time, in which to acquire facility in the use of his fingers in performing upon a piano, so he must have time in which to learn to use his eyes in botanical science.

Let our teachers, wherever possible, extend the time devoted to elementary botany so that it will reach through a school year.

Where it is not possible to devote more school time to this science, let the teacher arrange for a year's course with but one or two exercises each week. A pupil who devotes two exercises each week throughout one school year to botany will at the end of that time have a much better and far more enduring knowledge of the subject than if he had devoted five exercises each week to it for a single term. Properly managed, even one exercise each week for a year will bring better results than five exercises a week for one term. Two exercises each week in the fall term, one each week in the winter term, and two a week in the spring term is an arrangement which I have found to work excellently in practice.—*Charles E. Bessey.*

Botanical News.—Sereno Watson's contributions to American Botany, XIV., in the *Proceedings of the American Academy of Arts and Sciences*, vol. xxii. (pp. 396 to 481), consist of (1) a list of plants collected by Dr. Edward Palmer in the State of Jalisco, Mexico, in 1886, and (2) descriptions of some new species of plants. Among the interesting new things are two species of Begonia, one of Zinnia, two of Ipomœa, two of Salvia, five of Aristolochia, two of Habenaria, three ferns (Acrostichum, Notholæna, and Cheilanthes), and three species of Erythronium, the latter from Oregon. Three new genera are described,—viz., Mellichampia (*Asclepiadaceæ*), Prochuyanthes (*Agaveæ*), and Podistera (*Umbelliferæ*). The determinations of the Gamopetalæ and the descriptions and notes upon them are by Dr. Gray, the Juncaceæ and Cyperaceæ by Dr. Britton, the Gramineæ by Dr. Vasey, and the Filices by Professor Eaton.——"A Revision of the North American Linaceæ," by Dr. William Trelease, in *Trans. of the St. Louis Academy of Science*, vol. v. pp. 7 to 20, includes an arrangement and description of all our species of Linum, twenty-one in all. The paper is a welcome addition to the literature of systematic botany.——Thomas Meehan has recently read short papers before the Academy of Natural Sciences of Philadelphia upon the following subjects,—viz., "On the Interdependence of Plants," "On Petiolar Glands in some Onagraceæ," "Sugar in China," "Floral Calendars," and "Cortical Peculiarities in the Plum."——Professor T. C. Porter has just published (in *Proc. Acad. Nat. Sci. Phil.*) a valuable "List of the Carices of Pennsylvania."——Part 2 of *Pittonia* has come to hand. It contains much interesting matter, and has a delightful flavor of individuality and originality. The articles of most general interest are those describing the flora of San Miguel, a small island fifty miles west of Santa Barbara.——By the time this number of the NATURALIST reaches its readers the long-promised "Fresh-Water Algæ of the United States," by Rev. Francis Wolle, will be ready for distribution. It will appear in two volumes, the first consisting of three hundred and sixty-four

pages of text, giving descriptions of species, a glossary, and indices; the second volume contains one hundred and fifty-seven plates, representing over two thousand colored figures. The whole work embraces nearly thirteen hundred species. The price (ten dollars) is remarkably low, when we consider the expensiveness of the colored plates. The work may be obtained of the author at Bethlehem, Pa.

ENTOMOLOGY.[1]

Singular Adaptation in Nest-Making by an Ant, Cremastogaster lineolata[2] Say.—A month ago I received an ant's nest, sent by Assistant Engineer Henry A. Brown to General W. G. Lewis, of Goldsboro', N. C. The nest was built several feet from the ground on a bush, in the marshes bordering Broad Creek, Hyde County, N. C.

This ant usually nests "under stones or underneath and within the decayed matter of old logs and stumps. This material is sometimes prepared by the ant as a paper-like pulp, and arranged into cells and chambers, which are attached to the surface of the logs."[3]

This nest is about eighteen inches long by twelve inches in circumference at greatest diameter. I made a longitudinal section of it, and had a photograph taken, so as to represent both the external form and internal structure. The ants were alive in the nest when I received it. They were chloroformed before sectioning the nest. I took from the nest about one-fourth pint of adults, pupæ, and larvæ. They were collected in a mass through the chambers within a space four inches in length of the nest. This space is about two-thirds the distance from the lower end. The material composing the cells in this space is lighter in color than the other internal parts. It appeared also in the photograph, as can be seen by looking at the right-hand figure. Probably it will be visible in the photoengravure.

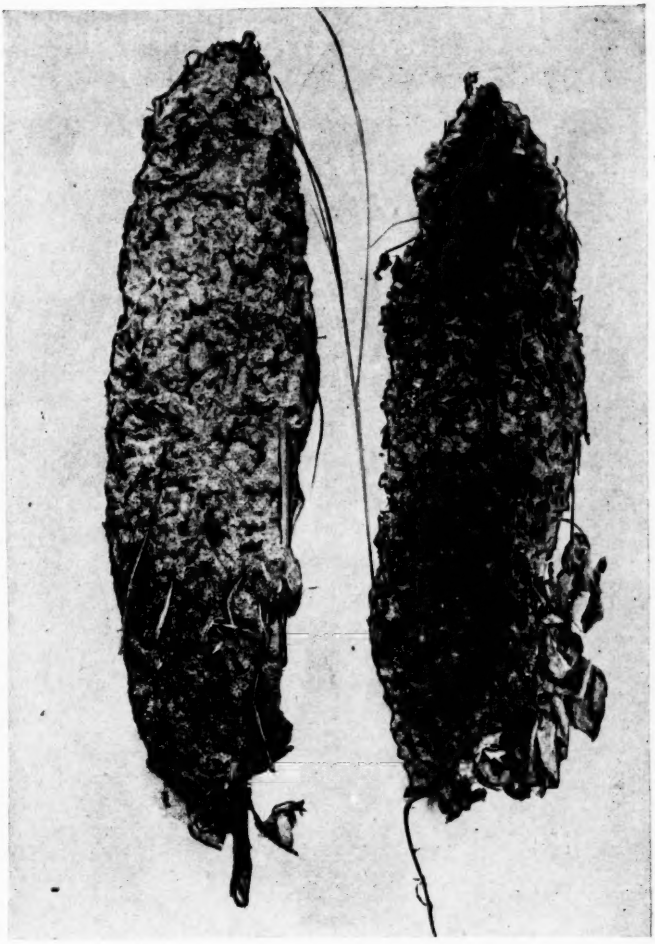
The material used in making the nest seems to be the same used by the ant in making its nest under stones, etc. Beside the woody pulp, a microscopic examination seems to reveal also some portions of dried grass. The nest is supported by the branches of the bush; a vine and some stalks of marsh-grass are fastened in it. Upon the outside the material is of a light gray color, much like that of the nest of the white-faced hornet. In the interior it is darker, in some places almost black. Probably the high tides causing the creek to overflow forced the ants to build their nest above the high-water mark instead of under

[1] This department is edited by Prof. J. H. Comstock, Cornell University, Ithaca, N. Y., to whom communications, books for notice, etc., should be sent.

[2] The ant was determined for me through the kindness of Prof. C. V. Riley.

[3] Comstock's Report on Cotton Insects, 1879, p. 188.

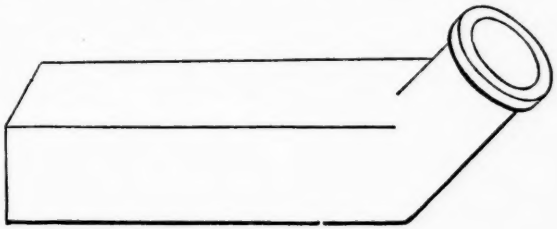
PLATE XXVI.



stones and within logs. One cannot help thinking that possibly some species of Hymenoptera, which now altogether build elevated nests, once built them near the ground, and being forced for a long time by conditions surrounding them, similar to these, finally acquired that habit permanently.

This would seem more plausible if General Lewis is correct in a fact which he states, that the yellow-jackets along Holly Creek, in Pender County, build nests on the bushes to avoid the tide. I mean to investigate this and see if they are the same species which under ordinary circumstances build nests in the ground. —*Geo. F. Atkinson, Univ. of N. C., Chapel Hill,* July 7, 1887.

A New Form of Vial for Alcoholic Specimens.—Frequently in Natural History museums it is desirable to display alcoholic specimens in vials placed in a horizontal position. This is true where table-cases are used; but it is more especially so in entomological cabinets, where the insect-boxes are in the form of



drawers. The use of the ordinary vials or insect-tubes in these cases is attended with serious difficulties. It is almost impossible to prevent the leakage of alcohol, and the consequent destruction of the specimens. In addition to this, the curved sides of the vial or tube make the contained specimens appear of very different form from what they really are. A long slender larva will appear to be much thicker than it is, while its length will not be magnified. A student, therefore, who does not remove the specimen from the vial will be misled as to its proportions.

To meet these difficulties I have had made a vial of the form represented in the accompanying figure. The bending of the neck prevents the leakage of the alcohol, and the plain sides prevent the apparent distortion of the specimen.

To fix the vial in place in an entomological cabinet, a white card is fastened to its lower side with liquid glue (the acetic acid and alcohol solution); the card is then trimmed close to the sides of the vial, but is allowed to project a short distance beyond each end. By means of these projections the bottle can be fastened in place with small pins.

The mould for these vials is the property of Cornell Univer-

sity, but it is with Whitall, Tatum & Co., New York, of whom the vials may be obtained.—*J. H. Comstock.*

Synopsis of the Hymenoptera of America North of Mexico.—It is with much pleasure that we call attention to a work by Mr. E. T. Cresson, which bears the above title, and the first part of which has just been published by the American Entomological Society.

The study of the Hymenoptera has been much neglected in this country, notwithstanding the great extent of the order, the wide range of variation in structure presented by it, and the fact that members of it exhibit the most wonderful development of instinctive powers known. This neglect of the order by students generally has been due to the fact that no specialist has heretofore given us a general work by means of which our forms can be determined. But we have now in this synopsis a guide which will enable the student to take up the study of the Hymenoptera and make satisfactory progress. The student who undertakes this work, however, must not expect to find the order as well worked up as are the flowering plants of our Flora, or even the Coleoptera of our Fauna. For, as stated by Cresson, "the greater part of the material collected together in the larger families has been very imperfectly studied, and our knowledge of the characters is very incomplete, so that years of careful study will be necessary before a classification can be produced that will be approximately complete." But this work will do much by the attraction of attention to the order to hasten the day when we shall have a complete classification. And it adds an order to the small list of groups which are available for study by other than specialists.

The part published consists chiefly of analytical keys for the determination of the families and genera. Many of these tables are compiled from the special papers of Wesmael, Holmgren, Westwood, Thomson, Taschenberg, Norton, Marshall, André, Mayr, Saunders, Howard, Cameron, Ashmead, and others. The second part, which is now in press, will contain a catalogue of the described species and bibliography, as well as a complete index. It is expected that the volume will consist of about 325 pages.

Liquid for Preserving Larvæ.—The following formula for the preparation of a fluid for the preservation of larvæ is given by Mr. Henri Trois (*Atti R. Istit. Veneto*, (6) tomo iii.).

Common salt	gr. 235
Alum	gr. 55
Corrosive sublimate	centigr. 18
Boiling water	litres 5

When the liquid is cold add 50 grains of carbolic acid. Let the liquid stand five or six days, and then filter. It is claimed that by means of this fluid the colors of larvæ can be preserved perfectly, even when exposed to a strong light.

ZOOLOGY.

Turning Hydra inside out; a Correction.—Will you allow me to correct a slight mistake that has crept into the pages of the AMERICAN NATURALIST? On page 387 of the April number it is stated that I have succeeded in turning Hydra inside out. The credit of having accomplished the feat should be given to Mr. C. Ishikawa and Mr. M. Kikuchi, both my assistants at the time. They devised simple but ingenious instruments for the purpose, and made the task of turning Hydra inside out a comparatively easy one, as I can testify from personal trial. Mr. Ishikawa made at the time many observations on the behavior of Hydra thus turned inside out. So far as I remember, Hydra, under these circumstances, generally quickly gained the right side out again, and if forcibly prevented from doing so by having a bristle put through its body, it still made frantic and almost laughable efforts to right itself. No definite results were reached, so far as I can recollect, in regard to the change of functions in the layers of the body,—at any rate something interrupted Mr. Ishikawa's observations before any definite conclusions were obtained, and that is the reason that nothing has been published until now. I hope that Mr. Ishikawa will take up the investigation again some time, and throw more light upon this interesting subject.—*K. Mitsikuri, Imperial University, Tokio, Japan*, June 2, 1887.

A Remarkable Case of Phosphorescence in an Earth-Worm.—On the night of June 20, 1887, when returning from placing some Phengodes females where they might attract the males, I saw in the path before me a small phosphorescent light. As I approached it became larger; now an inch, and the next moment two inches long. I was on the point of declaring I had found another Phengodes when suddenly it became three, four, and six inches long, now darting in this direction and then in that.

Thinking there might be an insect capable of running and giving a phosphorescent light to objects in its path in such a way as to cause them to be illuminated for a short time, I struck a match so that I might see to capture it. As the light of the match overcame the phosphorescence and lighted up the objects on the ground, the only insect I saw was a Myriapod scampering away under the leaves. All this took place in less time than it takes to tell it. Thinking the insect was hidden under the leaves, when the light of the match was extinguished I began to brush them away with my hand. The phosphorescence appeared again,

and the light advanced as rapidly as I moved my hand. I thought certainly I was in pursuit of the prize, and in my anxiety to capture it I would catch up a whole handful of earth. But I always noticed that I left the phosphorescent light on the ground. The insect eluded me, I thought. After pursuing the phantom in vain for some time, I stopped to ponder. After the habit of a puzzled man in an inquiring mood, I brushed my foot across the earth before me, when lo! each little pebble and pellet of earth bristled with a phosphorescent light. For a moment I seemed to lose confidence in the fact that all such phenomena are due to natural causes. The air was sparkling with fire-flies, and the earth at my feet was bristling with phosphorescence. Had time sped backward twenty centuries, and were the vestal fires lighting around me? Or was some great calamity impending? I seemed to hear these words repeated from the sky: "*Nate dea, quo fata trahunt retrahuntque, sequamur; Quidquid erit, superanda omnis fortuna ferendo est.*" But in a moment more I had brushed away these delightful superstitions, and went to work to find the *cause*.

Taking a quantity of the earth, I went to my study. First I took several pebbles into a dark room and rubbed them in my hands; no light appeared. Then I took some pellets of earth and treated them in like manner; result the same. Surely, I thought, the phantom lies in these decaying leaves, but disappointment was also the result of the third investigation. I returned to my package of earth, and saw a lone earth-worm writhing in pain. "I will try him," I thought. I took it into the dark room. It showed no sign of phosphorescence. I rolled it once across my hand. The *phantom* became *real*. Not only was the whole body of the earth-worm luminous, but the entire palm of my hand was aglow with phosphorescence. I made several trips to the place, and secured other worms which exhibited the same peculiarity.

Probably the Myriapod which I saw had pounced upon one of these worms for a meal. It became phosphorescent, which may have frightened the Myriapod, and it ran, dragging its prey, and the worm's body touching the ground illuminated it, thus attracting my attention. When the earth is disturbed, the friction of the body against the particles gives phosphorescence to them. The earth-worm is probably a species of Lumbricedæ.—*Geo. F. Atkinson, University of North Carolina, Chapel Hill, N. C.*, July 7, 1887.

Dwight on the Teleology of Bone-Structure.—Professor Dwight, of Harvard, thus concludes a paper on the cancellated structure of the bones of Vertebrata, in the Memoirs of the Boston Society of Natural History: "It appears, therefore, evident that so far from the actual structure of the bone

being the only possible one, it in many cases presents useless features, and that certainly there must be some determining factor besides teleology. Is it impossible to hold that the vertebræ of an alligator, for instance, could not answer their purpose equally well if the internal structure were more on the plan of mammalian vertebræ? Are there, then, not peculiarities of race that, in some cases at least, do not answer any definite purpose? It seems to me that there can be no reasonable doubt on the matter. It may be urged that we lack the knowledge to decide whether any given organism considered as a whole is or is not as good as its nature admits. It may be urged that an essential element of perfection is the due proportion of parts and faculties, and that it is impossible for us to say that the greater development in some particular direction would be for the welfare of the individual. I have no desire to dispute the great truth underlying these propositions, but in view of rudimentary organs alone, it would appear that, at least in some subordinate details, useless structures occur, and we have no means of deciding what limits to assign to the action of the causes producing them. It is certain that these appearances are not due to chance; there must be some determining cause modifying the structure in this direction. It is customary now to quote rudimentary organs and anatomical anomalies as evidences of descent, but it seems to me very improperly, occurring as many of them do quite out of the line of inheritance. This criticism applies with greatest force to anomalies, but rudimentary organs seem phenomena of the same general class. What principle, then, shall account for them? We must turn to homologies. We see within vertebrates a general plan; and, though great modifications occur, the plan persists. No liberties, so to speak, are taken with it beyond a certain point. There are never, for instance, more than two eyes or one mouth or four [*sic*] pairs of limbs. Is there reason to be sure that none of these, or analogous modifications, might not be for the benefit of the individual? Yet I think every student of natural history would look on the suggestion that they will never occur as chimerical.

"The principle of homology has a restraining influence on variations of structure, both in quasi-accidental instances, as in anomalies, and in transformation, of species (if that occurs), by restricting changes within the limits of the general plan.

"To condense further these deductions, it appears that the internal structure of any particular bone may show evidence of three factors: first, that of teleology; second, that of homology; third, that of correlation to the structure of other bones of the same animal: The relative prominence of these factors varies greatly. For example, in the humerus of the whale the first is of little moment, and so is the third in the heel-bone of the seal. Thus, while we find provision for the fitness of the part, we find

also sometimes apparently useless structures, sometimes apparently evidences of degeneration, but throughout are more or less distinct marks of harmony with other parts, and of homology with other forms. How has this been accomplished? Clearly the crude notion that accidental, purposeless, external forces should be sufficient to change by slow degrees one such organism into another of a different species is untenable. . The doctrine of chances alone shows it to be impossible. There is, moreover, the unanswerable argument of the inevitable uselessness of incipient structures. Where we see the need, we see the structure to meet it already perfect. We see also the combination of homology with teleology. Whatever, therefore, the share of evolution may be in the production of species, it is not one of chance. The changes must be for the most part comparatively sudden, and therefore due to an implanted, internal force acting in predetermined directions. On the theory of external accidental forces, the preservation of homology is incomprehensible. The action, however, of this internal force is, no doubt, modified by accidental secondary causes, which may produce degenerative as well as progressive changes."

Note on the Food of Amblystoma mexicanum.—In a recent note in *Science*[1] Dr. R. W. Shufeldt has placed on record some interesting "Notes on the Diet of Amblystomas," in which are given his experiments with meats of one and another sort in connection with captive specimens of the common *A. mavortium* of the Rocky Mountain regions. It has occurred to me that the following brief notes, incidentally made during the past winter, and based upon the contents of the alimentary canal of several alcoholic specimens of the common Mexican *Amblystoma* from Lake Texcoco, may prove interesting as connected with the ordinary food-habits of the free form. During the examination of some thirty specimens, conducted for anatomic purposes, it was found that twenty-two individuals contained from one to five specimens of *Cambarus montezumæ* Saussure,[2] some of which were still entire. Five specimens contained numerous examples of *Physa mexicana*, intermingled with which were many fragments of insects. In nearly all the specimens occurred many *Gammari* sp. indt. One individual contained a *Pisidium*, closely allied to *P. abditum*, associated with a half-digested minnow too much decomposed to admit of generic determination; the fish, when entire, must have been three inches in length. No plant-remains were found, save a few small roots, which were invariably associated with the *Cambari*, and doubtless swallowed with them. More or less

[1] Vol. ix., No. 216, p. 298, March 25, 1887.

[2] I am indebted to the courtesy of Prof. Walter Faxon, of Cambridge, for the determination of this form.

mud was found in every stomach examined, the greatest quantity in those stomachs containing the *Physæ*. Attached to the fauces of several individuals were found sometimes as many as a half-dozen specimens of a nematode worm belonging to *Strongylus*. The stomach of one individual was completely devoid of food-remains of any sort, but was completely filled with clusters of this nematode hanging from its walls.

It would seem, therefore, that in a free state *Amblystoma* is carnivorously omnivorous.—*R. Ellsworth Call.*

The Turkey-Skull.—Dr. R. W. Shufeldt has recently published the results of his comparisons of the skulls of wild and domesticated turkeys, undertaken with a view of noticing the changes brought about by domestication. His results in brief are:

1. In the wild bird the nasals fuse with the frontals, but in the domestic bird they are separated by a persistent suture.

2. In the wild turkey the cranio-frontal region is wider and more concave than in the tame variety.

3. The parietal prominences are more evident, and the median longitudinal from these to the occipital ridge is shorter in the wild than in tame birds.

4. The occipital area in the wild turkey is cordate, the apex upwards; in the tame turkey it is roughly semicircular.

5. The intraorbital septum is entire in the wild bird, perforate in the tame.

6. The pterygoids are longer and more slender in wild than in tame varieties.

7. The skull is denser and thicker, as well as smoother, in the tame than in the wild bird.

These points and three others mentioned by Dr. Shufeldt hold good for the majority of specimens, but in a large series of skulls examples may be picked out which are intermediate in position. The characters are all comparative, and exceptions are numerous. The studies are not of a diagnostic but of a comparative character, and form an interesting addition to our knowledge of the changes produced by domestication in a comparatively short time.

Anatomy of the Auks.—Dr. Shufeldt, in studying the visceral anatomy of specimens of *Brachyrhamphus marmoratus* and *Synthliborhamphus antiquus*, notes that these two forms, closely allied in the systems, differ greatly in their visceral anatomy. In the ancient murrelet the lower part of the larynx is covered in front by a large mass of fat, lacking in the marbled murrelet. The lateral and sterno-tracheal muscles are the only tracheal muscles present, and these agree quite closely, except that the latter are given off much higher in the marbled than in the ancient murrelet. The differences in the hearts are quite marked, but may result from the action of the preserving-fluid, as this

organ is described as smaller and more pointed in one than in the other. The livers differ considerably, being longer and larger in the ancient than in the marbled species. Considerable differences are also noted in the full bladders. Dr. Shufeldt calls attention to the fact that well-preserved spirit specimens of many Arctic birds are still desiderata in our museums, and requests others who may have the opportunity to make comparative studies on other auks.

Domestication of Wild Fowl.—My success so far this year has been better than last, although far short of what I expected. There seems to be no available information on this subject, at least none that I have had access to, and I have for the past few years been learning from failures. Last year I hatched four Chinese mandarin ducks and they lived a week. Their deaths may be attributed to close confinement, and, perhaps, to an artificial diet of corn-meal, boiled potato, and boiled egg.

This year I turned out in a swampy piece of land, with a large spring pond in it, seventeen pairs of wood-ducks, ten odd drakes, and one pair of pintails. They were confined on about an acre of ground by a wire netting three feet high.

All winter these birds had been together and had paired off. They were confined in a small enclosure near one of the windows of the fish hatchery, and were at all times in sight, and it was noticed that the females made all the advances through February and March. Therefore the extra drakes were thought to be harmless. About the first of April they were turned out in the swamp, and furious fighting was noticed among the males, and by the middle of April three of the ducks were seen with their scalps torn off. It was also noticed that the males gave them no rest, and then, perhaps too late, the extra males were removed. Nests were provided for them by placing boxes about two feet from the ground in the alders, and in one of these a duck laid ten eggs; in another three were laid, and two eggs were found upon the ground. These were placed under hens, and from them I have three young, now, July 8, two weeks old, which are strong and vigorous, but refuse all food that we offer, and spend their time in catching flies. They roam out alone, but come up to the building with the old hen.

Back of my house, around a fountain, we made an enclosure which provided a good run of grass, and there I placed one pair of mandarins and four pairs of wood-ducks. The wood-ducks did not lay, but the mandarin laid twelve eggs; nine of these were placed under hens, and five hatched. Three eggs were left with the mandarin, and after setting a week she abandoned them. Of the five mandarins two were killed under the hen. One was a perfect albino, but lived only four days; the remaining two are vigorous.

In a ravine which has a spring pool in it I placed two pairs of blue-wing teal. One of these birds was the mother of the rest, and was raised by a man in Iowa, but no eggs have been laid by them.

My pintail duck made her nest on the ground in a clump of ferns, and set on seven eggs. The day that she was due to hatch she disappeared, and no trace of her, the young, or even the egg-shells, remain. We think she escaped somewhere, perhaps over the netting, for I have seen a wood-duck, although pinioned, go over a wire netting, by means of feet and wings, when first placed in strange quarters. They would go up with a sort of running fly and fall on the other side.

It is possible that, had the wood-ducks been turned out in pairs, and no odd drakes been placed with them, the result would have been better. There is a great deal of natural food in their enclosure, and they have all the corn, wheat, and oats that they can eat; they prefer corn to anything else and eat that first; next they take wheat, and only eat the oats when nothing else is left.

Next year I hope to try again under slightly different circumstances, such as proper mating and different food, and in the mean time I will be glad to have the experience of others in this line.—*Fred. Mather, Cold Spring Harbor, N. Y.*

Zoological News.—ECHINODERMS.—In the *Zoologische Anzeiger* for May 31 H. Ludwig points out that the so-called parasite of Pterotrachea described by Barrois under the name *Trichœlina paradoxa* is in reality the pedicellarium of some Echinoid (probably *Sphærechinus granulatus*) which had become detached. It was regarded by Barrois as a problematical form with Echinoderm affinities.

The readers of Romanes's work upon starfishes will be interested in Dr. Preyer's experiments on the motions of these forms as detailed in a late number of the *Mittheilungen* of the Naples Zoological Station.

WORMS.—Mr. A. G. Bourne, now in India, writes to *Nature* of June 9 calling attention to the sensory powers possessed by the leeches. After alluding to Whitman's observations on the land-leeches of Japan, he records that he took a stone from the bed of a brook with his hand, and almost immediately several leeches came swimming to the spot. Thinking that smell or taste might have had something to do with attracting them, he returned the next day and stirred the water with a stick, but without producing any result. He then washed his hands in the water, taking care not to disturb the ooze on the bottom, when the leeches reappeared and swam about as if they realized the presence of a living being.

Ludwig Plate describes, in the seventh volume of the Naples *Mittheilungen*, some new ectoparasitic Rotifers from the Gulf of Naples. They belong to the family Seisonidæ, and, like all the other members of the group, occur attached to Nebalia. The forms described, four in number, belong to the new genus Paraseison, which is characterized by an absence of intestine, and has the wheel either as in Seison, or reduced to tactile bristles, or, lastly, entirely absent. The other genera of the family—of which a synopsis is given—are Seison of Grube, with two species, and Saccobdella of Van Beneden and Hess, with a single species.

Molluscs.—Prominent among the papers in the twenty-sixth volume of the *Journal de Conchyliologie*, just completed, may be mentioned an account of the Molluscan fauna of the valleys of the Tage and the Sado, Portugal, by Nobre; descriptions of new species of Molluscs from Annam, by Wattebled; from Cambodia and Tonkin, by Morelet; and from China, by Hende.

EMBRYOLOGY.[1]

A Theory of the Origin of Placental Types, and on certain Vestigiary Structures in the Placentæ of the Mouse, Rat, and Field-Mouse.—The discoidal placenta has been supposed by Balfour to have been derived from an earlier and less specialized diffuse type. He, however, gave no connected, and, as it seems to the present writer, no plausible view as to the causes leading to the gradual restriction of the placental area. Although I have already given partial expression elsewhere to the following views, I am now able to state them with greater clearness, owing to the fact that the placentation of the common mouse has very unexpectedly afforded some remarkable evidence in proof of the doctrine of the mechanical genesis of placental types first suggested by me.

The view which the writer holds is essentially as follows: (1) The primitive form of the placenta approximated that of the so-called diffuse type. (2) The primitive type of uterus was duplex or bipartite, and its cornua were therefore tubular. (3) Development in one of the cornua of such an uterus, as the blastosphere enlarged, must have caused the latter to touch the uterine mucosa around a zone embracing its equator, just as a sphere thrust into a flexible tube would be in annular contact with the inside of the latter. (4) If the blastosphere became elongated or fusiform within the tubular uterine cornua, as in Carnivora and Ungulata, a still greater portion of the outer surface of the blastosphere would be brought into contact with the mucous membrane of the tubular uterus, and the conditions for

[1] Edited by John A. Ryder, Ph.D., Biological Department, University of Pennsylvania, Philadelphia.

the development of the zonary, diffuse, or cotyledonary placenta would be established.

Just here it may be well to call attention to the fact that the bare poles of the chorion in the diffuse type of placenta, as seen in the Mare and Dugong, show conclusively that we cannot draw a sharp line of demarcation between the diffuse and zonary types of the placenta. It follows, without any doubt whatever, from what has been said in the preceding paragraph, that the so-called diffuse type of placenta is merely a special case of the zonary, in which smaller polar areas have been left bare of villi because of more extensive contact of the chorion with the uterine mucosa. These small, bare areas of the chorion in the diffuse represent the larger, non-villous poles of the zonary type; so that, in reality, all so-called diffuse placentæ are zonary,—*i.e.*, they are a very wide type of the zonary, in which the villous belt extends over nearly the whole of the outer superficies of the chorion.

It may also be safely affirmed that the decidua acquires importance in proportion to the concentration of the placental or villous area of the chorion, because in the diffuse type the decidua is either meagrely developed or wanting.

The concentration or diminution of the placental area also depends, to a great extent, upon the degree to which the allantois is extended over the subzonal membrane; but the gradual restriction of the area covered by the allantois must have had some determining cause. The influence which would be adequate to produce such a restriction could only be a physiological one, determined by the mechanical relations of the parts involved, and it is therefore almost certain that the extension or restriction of the allantoic area would be determined by the proportions of the surface of the chorion brought into contact with the vascular walls of the uterus, or by the restriction of the vascular and deciduous area in the walls of the uterus itself. The last-mentioned type of restriction is of great importance in connection with the origin of the discoidal type of placenta, because it is probable that from the diffuse type of placenta the zonary has been derived, while from the latter it is in the highest degree probable that the discoidal has arisen in virtue of the restriction or reduction of the maternal vascular and deciduous surfaces of the uterus. The new evidence, which I will now present on this point, as observed in *Mus musculus*, *M. decumanus*, and *Hesperomys*, will, it seems to me, leave little doubt as to the essential correctness of the views set forth above, even after we make due allowance for the effect of uniparity and pluriparity, because it is very probable that pluriparity has tended to preserve the primitive bipartite or duplex type of uterus with its right and left tubular halves, in order that a number of fœtuses could be nourished in each uterine tube at one time, as in Rodentia.

In the latter, when the fœtuses are somewhat less than half

grown, it is very evident that there is an annular thickening of the uterine wall (shown at *v* in A and B of Fig. 1). Dissection reveals the fact that this annular thickening is nothing else than a part of the decidua, as it is closely adherent to the fœtal membranes, and extends from either edge of the decidua of the discoidal placenta (*p*) around over the back of the embryo, as shown at B and C in Fig. 1. This thickened portion, or decidua, if isolated, together with the placenta, and unrolled upon a flat surface, would appear as shown at D in Fig. 1. The question immediately arises, What is the nature of this structure? It seems to the writer that there can be no question that its position and

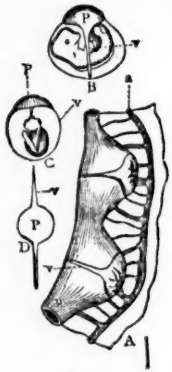


FIG. 1.

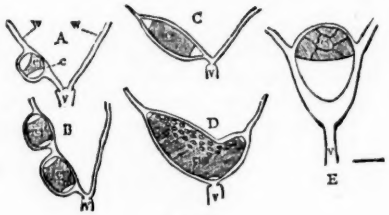


FIG. 2.

relations indicate that it is a vestige of the zonary type of placenta which must have been developed in the ancestors of the Rodentia.

All of the placental girdle, in the light of this evidence, has been aborted in the Rodentia, except a small discoidal segment nearest to the blood vascular supply on the mesometric side of the uterus, as shown at A in Fig. 1, where *a* represents the uterine artery (the vein has not been indicated in this diagram). The functionless part of the decidual girdle in existing murine types shows that the ancestral Rodentia possessed a zonary placenta. We may confidently affirm this, in spite of the anomalous mode of development of the Cavys and Murine types, because there is good reason to suppose that the types of development presented by both the latter have been derived by descent with modification from a type approximating the more primitive one, which was similar to the less specialized mode of development of the Rabbits and Hares.

We may suppose, further, that the zonary girdle first began to narrow and abort on the side of the uterine tube opposite to and most remote from its mesometric aspect, and, consequently, farthest away from the blood vascular supply of the organ. This is shown diagrammatically in Fig. 2, at A, where *w* represents the wall of the left and *w'* that of the right uterine tube, *c* the chorion, *e* the placental girdle and the form of the area covered

by the decidua, and *v* the vagina. We may suppose Fig. 2, A, to represent a type intermediate between that shown in Fig. 1 and that represented in Fig. 2, at B, which is that characteristic of certain Carnivora,—the Cat, for example. In C, Fig. 2, the hollow chorion has become more elongated,—in fact, fusiform; its bare poles are conical instead of flat, as in B, while the villous portion, *e*, is a broad zone. This type is found in the Dog and in *Phoca*, in which, at certain stages, it is very strongly marked. In all these types placentation occurs exclusively in either the right or left half of the uterus, but in the still more specialized uniparous types, to be next described, we find that portions of both right and left halves of the uterus present more or less mucous surface to the single chorion which they enclose. In spite of this, however, we may still discover traces of the zonary condition in D, Fig. 2, which represents the relations of the chorion to the right and left horns of the uterus in the Mare and Dugong, while, if the villi are aggregated into little tufts mainly on the mesometric side, as shown by the small, oval areas, we would have the condition found in the Cow. In this last type we find three bare areas on the chorion,—viz., at either pole, and another overlying and exactly opposite the *os uteri*, as shown in D, Fig. 2.[1] In the so-called diffuse type, represented by D, it is clearly seen that the villous zone is a very wide one, and it is also clear that the type D must have been derived from one similar to that shown at C, Fig. 2. In fact, if the chorion and embryo in the left horn of C were slipped down so as to lie partly in the right horn, we would get a condition practically like D. With the still greater specialization of the uterus, as a result of which its cavity is no longer tubular, but pyriform, in the gravid state, as shown at E, Fig. 2, other modifications of the placenta supervene. The globular chorion found in the type E (uterus simplex of Man, Apes, and several Edentates) still tends to develop the placenta at the cardiac or mesometric side. In the case of *Tamandua*, *Cycloturus*, and *Bradypus* there is a more or less well-marked lobulation of the discoidal placenta, which is probably a reminiscence of cotyledons which have suffered approximation, as the type of uterus D passed into that shown at E. In the Primates the simple discoidal placenta of the highest types and the two unequal placental disks of the Old World monkeys are further modifications of a type which must have been primitively zonary or diffuse, as is proved by the placentation of the Lemuridæ, which is similar to that of D, Fig. 2. Such a view is further countenanced by the fact that in its earliest condition the placenta of the Primates is essentially diffuse in its character.

[1] These bare areas seem to have arisen in consequence of the failure of the surface of the chorion to come into intimate contact with a vascular maternal surface at these points.

The facts as interpreted above seem, to me, to leave no doubt regarding the great influence which variation in the mechanical relations of the chorion to the uterine walls has exercised in the evolution of placental types. This, coupled with the influence exerted by the varying fertility of species, the variation in the vascularity of different parts of the uterine walls, and the form of the uterine cavity, has, doubtless, been the all-important factor in the evolution of the various existing types of gestation.—*John A. Ryder*, June 24, 1887.

ANTHROPOLOGY.

Arrow-Release among the Navajos.—Yesterday (28th March, 1887) I was out with my camera upon one of the hills which closely surround the frontier military post of Fort Wingate, New Mexico. On the site referred to are built three Navajo lodges, or "hogans," as they are called,—two of the old original structures of the tribe and one of the more recent dwellings, or plan of building. Having made my intentions known, that I desired a picture of a warrior in the act of shooting his war-bow, there soon gathered about me some eight or ten venerable-looking old Navajo bucks, two or three of whom had their war-bows and arrows with them.

Having just read with great interest Professor Morse's pamphlet on arrow-release, a copy of which he had kindly sent me, it was with no little curiosity that I handed a bow and two or three arrows to an old gray-headed warrior present, and asked him, "Draw,—as if you were about to kill the worst enemy you had in the whole world." A particularly savage expression came over the old fellow's countenance at the suddenness of my request, but he seized the bow and arrows, and immediately drew one of them to its very head. This is the position he stood in at the time: his left foot was slightly in advance of the right, the bow was firmly seized at its middle with the left hand, while it was held somewhat obliquely, the upper moiety inclining towards the right from the vertical line, and, of course, the lower limb having a corresponding inclination towards the left side. The two spare arrows were held with the bow in the left hand, being confined by the fingers against its right outer aspect. With the right hand he seized the proximal end of the arrow in the string, using the thumb and index finger, at a point fully an inch or more above the notch, and consequently including the feathers. The "ring finger" bore against the string below this seizure, and its pressure was reinforced by its being overlapped by the middle digit, the little finger being curled within the palm of the hand.

This corresponded to Professor Morse's "secondary release" as figured on page 8 of the above referred to pamphlet, with the exception that the middle finger should overlap the annularis,

and was not of itself used to draw back the string. Returning to our Navajo warrior, I noticed, too, that the arrow at its head was on the *left side* of the bow and simply rested on top of his clinched hand. This man wore, in common with all the others who used the bow, a stiff leather "brace" fastened by buckskin strings about his left wrist, the collar being about two inches deep, and this in several others who stood near and who wore them was ornamented with silver buttons. He drew the arrow back and forth three or four times without changing the position of his fingers or hands, when I suddenly asked him to shoot as if he were going to kill a squirrel running up a tree. He smiled at this and simply drew the bow the *same way*. Upon further questioning him, he told me that the Navajos rarely held their spare arrows in the bow hand, as he now had them, but carried a scabbard (quiver of buckskin) full in front of them, from which they could be removed with great rapidity while firing; this he pre-eminently demonstrated to me from one of the scabbards worn by an Indian there present.

Still, without letting them know what I was after, I handed the bow and arrow to another buck, a man especially noted for his skill in the use of the weapon, and he immediately assumed precisely the same attitude; whereupon the first old fellow laughed and applauded at the same time, saying, "What did you ask him for? All the Navajos shoot the bow and arrow exactly alike." I replied that I dare say they did, and handed it to a third one, and sure enough he assumed the same position. I was determined, however, to let every one of them try it, and as the fourth fellow seized it, I observed that he steadied the arrow against the bow with the index finger of his left hand, which he extended lightly along the continuity of the shaft. Further, his middle finger did not overlap the annularis, but bore against the string lightly above it. Here was a typical "secondary release," and it was followed up by several others present, so I came fully to the conclusion that the true method of arrow-release among the Navajo Indians was the secondary type as classified by Professor Morse.

Next day I went among them again, and they had evidently been talking the matter over, and several new men being present, they were eager to show me the exact methods.

I found that they *on all occasions* where force was required used the secondary release, but where they shot lightly at short range they used the "primary release." Now, these observations were all made with unusual care on my part, as I had no sooner commenced them than I found that they disagreed with the observations of a no less distinguished observer than Colonel James Stevenson, who reports through Professor Morse in his first pamphlet on arrow-release, "that Navajo Indians practise three methods of release,—namely, the primary release already alluded

to, the tertiary release, and a variety of the Mediterranean release" (pp. 10, 11).

At any rate, as I say, all the Navajos which I examined, when not using the primary release employ in connection with the index finger and thumb of the right hand the annularis digit to assist in drawing back the string when charged with an arrow.

These arrows have an elaborately made "notch," are armed with three feathers, and tipped with thin and flat heads of iron, made sharp with a file. The feathers are attached about an inch above the notch, and are placed at an equal distance apart on the cylindrical shaft. Sometimes the plane of one of these feathers will be at right angles to the notch, but again the arrangement may be otherwise, and I am satisfied they have no special rule in putting them on. Deer-sinew is used to wrap them, as it is to confine the iron head at the distal extremity of the shaft.—*R. W. Shufeldt, U. S. Army, Fort Wingate, New Mexico*, 29th March, 1887.

The Great Serpent Mound.—In the archæological world one of the most important bits of news is the purchase of the "Great Serpent Mound," in Adams County, Ohio, by the Peabody Museum of American Archæology and Ethnology. At the time of the explorations of Squier and Davis (1849) it was covered by a heavy growth of trees, but most of them were prostrated by the great tornado of 1859, since which time the elements have seriously damaged it. Knowing this fact, Professor F. W. Putnam, of the Peabody Museum, wrote a letter advocating the preservation of this prehistoric monument, and as a result several ladies of Boston have raised money sufficient to buy the mound and about sixty acres of land about it. It is the intention to convert this into a public park, erecting a fence around the portion containing the mound, so as to keep out horses and cattle. Professor Putnam will revisit the mound in the fall and superintend the improvements. A grove of trees will be left outside the fence, where picnic-parties may assemble. The mound itself is a long earthen embankment on the edge of a bluff a hundred feet high. For the greater portion of its course it coils in a very snake-like fashion, the tail being coiled in a spiral, like a watch-spring. The head of the serpent is represented as wide open, and in front of it is an oval about ninety feet long, and still farther in front of this, extending to the point of the bluff, is an ill-defined portion which some have likened to a jumping frog, while others think it is merely produced by cattle-tracks. "Accurate measurements" of the length of the serpent vary all the way from about seven hundred to fifteen hundred feet, the last two surveys giving totals of twelve hundred and forty and fourteen hundred and fifteen feet; some of the discrepancies being explicable by the difficulty in following the centre of the constantly-curving outline. It is certainly fortunate that this, one of the most wonderful of the In-

dian mounds, is thus assured of preservation, for many others are fast disappearing by the action of the rain and of the plough.

The Ruined Cities of Yucatan.—Mr. E. H. Thompson, United States consul at Merida, Yucatan, has been making researches among the ruined cities of that region, and concludes that a moderate view must be taken of their age. They are not as old as some anthropologists believe, nor are they so modern as Charnay holds. He explains their present ruined condition by the climate and tropical vegetation combined with faulty construction. The dirt and débris which in many localities serve as an index of age and as a basis for chronological computation are here lacking. As all these ruins are built on mounds or hills, all accumulations of matter about them can come from only two sources,—that brought there by living forms and that resulting from the decay of the structure itself, while the winds sweeping through the deserted corridors will carry away the smaller portions of that thus accumulated. In regard to the uses of these buildings Mr. Thompson differs from most archæologists, who have come to regard them as communal dwellings. Mr. Thompson rather inclines to the view that the dwellings of the people covered a large space, but, being built of perishable materials, have entirely disappeared. In reply to the statements of eminent archæologists that no traces of such towns exist, he quotes the case of Labna, which is rarely visited, even by the natives themselves. The whole region for leagues around this ruin is dotted with low mounds and small, rectangular terraces, some hardly raised above the surrounding level, while others are of greater altitude, though none are so high as the mounds which support the ruins. Now, asks Mr. Thompson, "if these do not mark the sites of what were once dwellings, to what purpose can we conceive that they were put? Those who are familiar with the habits engendered by a life in the tropics will be ready to affirm that they were not built simply for the pleasure of working." Further, they are too numerous and in such situations as to forbid the idea that they were the sites of additional temples. Mr. Thompson is continuing his explorations of Labna, which promise to give good results, as the locality has been almost entirely undisturbed.

SCIENTIFIC NEWS.

—Professor E. N. Horsford, of Harvard, has recently done a good work in printing Zeisberger's Indian Dictionary. David Zeisberger was a Moravian missionary, who began his labors among the Delaware Indians about 1740, and continued them uninterruptedly for sixty years. In this way he acquired an extensive knowledge of the Delaware tongue, while the fact that the Delawares were vassals of the Iroquois gave him an opportunity to become acquainted with the Onondaga language. When he died his manuscript dictionary passed, after various vicissitudes, into the library of Harvard College, where it was recently found. In publishing it Professor Horsford has not ventured to alter in the least the manuscript of the old missionary, so that the printed text reproduces exactly the original, except in chirography. It makes a volume of two hundred and thirty-six pages, printed in four columns, English, German, Onondaga, and Delaware, the English rather peculiar and the German somewhat antiquated. An edition of the work has been given to Wellesley College, to be used as exchanges in filling the alcove of aboriginal literature which Professor Horsford has founded there.

—The report of the New Hampshire Fish and Game Commissioners for 1886, which is just published, gives some interesting statistics. Their principal labors were confined to landlocked salmon and brook-trout. At the Plymouth hatchery they have hatched and distributed three hundred and fourteen thousand brook-trout, one hundred and thirty-five thousand landlocked salmon, six hundred thousand Penobscot salmon, and one hundred and twenty-five thousand of other fish, mostly whitefish and Lake Superior trout. The total number of brook-trout distributed for the year was six hundred thousand. The commissioners say that the enforcement of the game laws has done much good in increasing the numbers of partridge and other game-birds, while in the northern and central counties of the State deer have rapidly increased in numbers, and during the past year were seen in many towns where none have been known for many years.

—Professor Hubert Ludwig, of Giessen, has been called to the Zoological Institute in Bonn, as successor to Professor Richard Hertwig. His place as professor at Giessen has been filled by the appointment of Dr. J. G. Spengel, who has been the director of the Scientific Museum in Bremen. Dr. H. Schauinsland, of Munich, goes to Bremen.

—The Johns Hopkins University fellowships in biology are to be filled for the coming year by A. C. Wightman and H. V. Wilson.

—Dr. Walter Voigt, of Würzburg, has been appointed assistant in the Zoological Institute at Bonn. The position of assistant in the Zoological Zootomical Institute of Würzburg thus left vacant has been filled by the appointment of Dr. Franz Stuhlman.

—It is reported that the Grand Duke Nicholas, of Russia, is an enthusiastic student of natural history, and that he has recently completed a work on the entomology of the region of the Caucasus.

—The Ohio State Archæological and Historical Society announce the beginning of the *Ohio Archæological and Historical Quarterly*, the first volume of which will contain, among other archæological material, a bibliography of the mounds of Ohio, arranged alphabetically by counties and towns. The editorial board consists of Professors George W. Knight, B. A. Hinsdale, W. H. Venable, G. Frederick Wright, and Dr. I. W. Andrews. The yearly volume will consist of about four hundred pages, and will be sent free to members of the society, while to others the price is one dollar per copy.

—The Essex Institute at Salem, Mass., is at last in possession of a home of its own. Founded in 1848 by the union of two previously existing societies, it has always been a tenant until now. For many years it has shared the building of the Salem Athenæum, but its quarters there were far too small, and for several years it has been unable to even provide shelf-room for its library. A year ago it purchased the adjoining estate, and since that time it has been busy in fitting up the large and commodious dwelling-house there for its new purposes. This building is of brick, three stories in height. A small annex, which extends to the roof of the main building, has been rendered fireproof, and will be used for the storage of the more valuable portions of the Institute's collections. The Institute has now a library of over fifty thousand volumes and upwards of two hundred thousand pamphlets. It is rich in historical and scientific works, especially those of the early part of this century. With the expenditure of a few hundred dollars its scientific side would have but few rivals in the United States. The Institute, twenty years ago, placed its natural history collections as a permanent deposit with the Peabody Academy of Science, but it still retains a museum of historical specimens.

—Professor James D. Dana has gone to the Hawaiian Islands for the summer. He will pay especial attention to the geological changes which have occurred since he visited the islands as a member of the United States Exploring Expedition under Commodore Wilkes.

—*Science* has adopted a new form with the beginning of its new volume. It is now a slightly larger sheet than before.

—Mrs. A. T. Bruce, of New York City, the mother of the late Dr. Adam T. Bruce, whose untimely end has been chronicled in these pages, has given Johns Hopkins University ten thousand dollars to found a fellowship in biology as a memorial of her son.

—Professor A. DeBary, of Strassburg, has received a call to the chair of botany and directorship of the Botanical Institute of the University of Leipzig, left vacant by the retirement of Professor A. Schenk.

—Dr. W. Branco, who has been a privatdocent at Berlin, goes to the University of Königsberg as professor of geology.

—Dr. Karl Dahl, the zoologist, and Dr. H. Traube, the mineralogist, have entered upon the duties of their professorships at the University of Kiel.

—Mr. Carl Eigenmann has gone to the Pacific coast. He hopes while there to make a study of the Embiotocoid fishes.

—Professor Barton W. Evermann, of Terre Haute, Indiana, will spend the summer collecting in the Gulf of California.

—Dr. Karl Möbius, who is well known for his researches in the Bay of Kiel, has been called to Berlin as professor of zoology and director of the museum in the University.

—Professor P. Falkenberg, formerly of Göttingen, goes to the University of Rostock to take the chair of botany there.

—Dr. A. Gravis, who has been at Brussels, has been elected professor of botany at Lüttich.

—Recent Deaths.—May 20, Professor Alexander Ecker, the well-known anatomist and anthropologist of Freiburg, at the age of seventy.——Professor J. E. Areschong, the Swedish botanist and author of several important works on Algæ, at the age of seventy-six.——Norbert Michot, editor of "The Flora of Hennegaus," at Mons, aged eighty-four.——Professor D. F. Didrichsen, professor of botany, at Copenhagen, March 19, aged seventy-three.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Kansas Society of Natural History.—I have to report the organization in Leavenworth of the Kansas Society of Natural History, with the following officers:

Dr. R. J. Brown, President; Dr. Chas. A. Carpenter, Vice-President; W. R. Lighton, Secretary and Treasurer.

The membership assures activity in the work which has been outlined, and this work is to embrace the study of all of the natural sciences, "with special reference to such as are of economic importance to the State of Kansas."—*W. R. Lighton, Secretary, Leavenworth.*